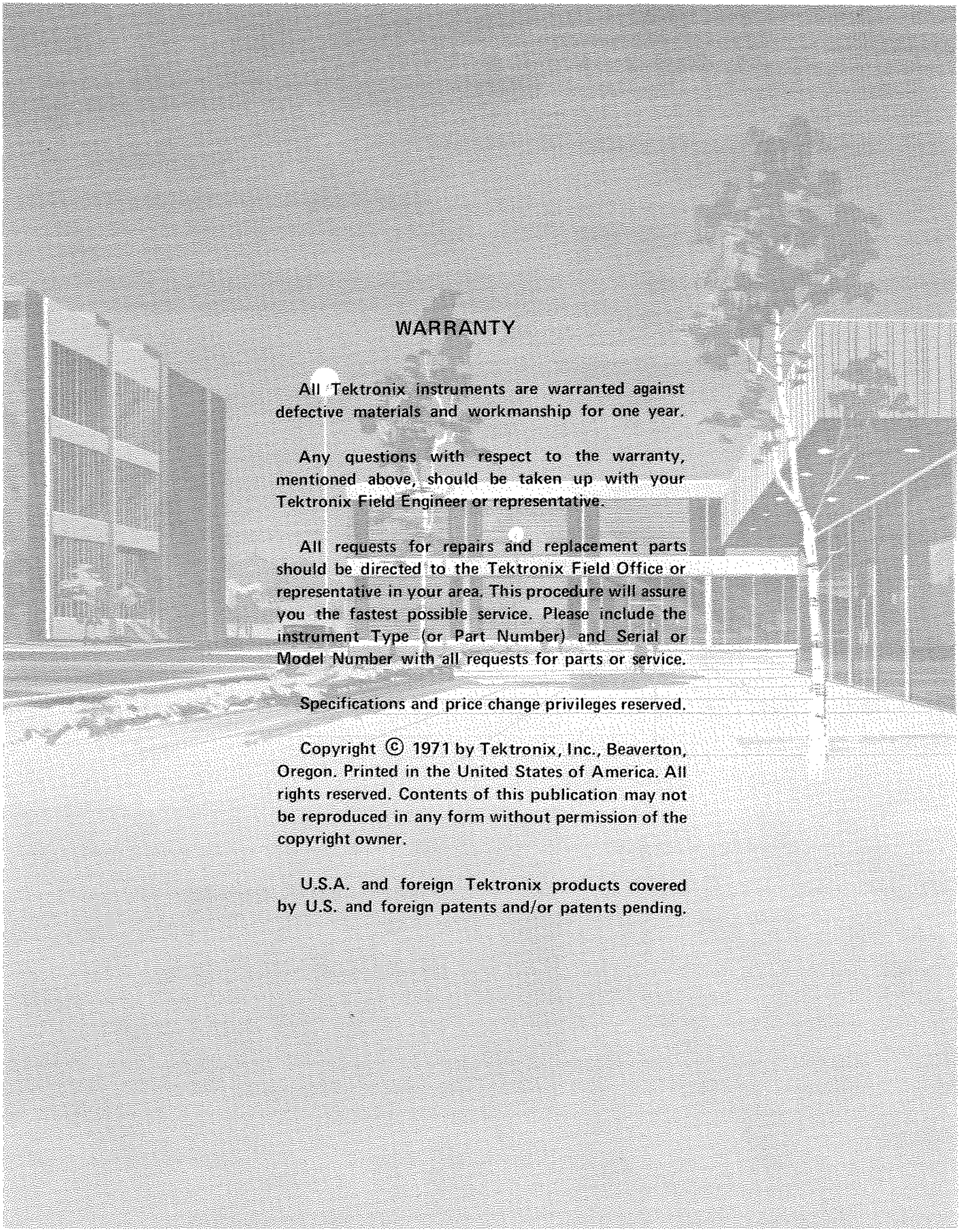
INSTRUCTION MANUAL

Serial Number ____________

5B10N TIME BASE / AMPLIFIER

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Fig. 1-1. 5B10N Time Base/Amplifier.

SECTION 1
SPECIFICATION

Introduction

The 5B10N Time Base/Amplifier is a time-base plug-in unit to generate a sweep in Tektronix 5100-series oscilloscopes. The unit features solid-state circuitry and simplicity of front-panel controls, which include a lighted knob skirt to provide direct readout of calibrated sweep rates and deflection factors. The 5B10N provides normal sweep rates from one microsecond/division to five seconds/division; a X10 magnifier extends the displayed sweep time per division to 100 nanoseconds. Additionally, the unit accepts external signals to be displayed in lieu of the time-base sweep.

In this manual the word Volts/Div or division refers to major graticule division.

The following electrical characteristics apply over an ambient temperature range of 0°C to +50°C. Refer to the 5100-series Oscilloscope System manual for environmental characteristics.

TABLE 1-1

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement		Supplemental Information
Sweep Rate			
Calibrated Range	Five seconds/division to one microsecond/division		21 steps in a 1-2-5 sequence. X10 magnifier extends displayed sweep time/division to 100 nanoseconds.
Displayed Accuracy	Normal	Magnified	
1 µs/div to 1 s/div	Within 3%.	Within 4%.	
2 s/div and 5 s/div	Within 4%.	Within 5%.	
Uncalibrated (Variable) Range			At least 2.5:1.
POSITION Range			Any portion of the sweep can be positioned on screen.
Triggering Requirements			
Internal			
DC (Direct) Coupled	At least 0.4 division, DC to 1 megahertz, increasing to 0.6 division at 2 megahertz.		
AC (Capacitive) Coupled	At least 0.4 division, 50 hertz to 1 megahertz, increasing to 0.6 division at 2 megahertz.		
External			
DC (Direct) Coupled	At least 200 millivolts, DC to 2 megahertz.		
AC (Capacitive) Coupled	At least 200 millivolts, 50 hertz to 2 megahertz.		

TABLE 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
External Trigger Input		
Input R and C	1 megohm, within 2%, paralleled by less than 70 picofarads.	
Maximum Operational Input Voltage	+ and − 5 volts.	
Maximum Safe Input Voltage	350 volts.	
Level Range		
Internal		
DC (Direct) Coupled		+ and − 15 divisions from graticule center.
AC (Capacitive) Coupled		+ and − 15 divisions from signal mean.
External		
DC (Direct) Coupled		+ and − 5 volts.
AC (Capacitive) Coupled		+ and − 5 volts from signal mean.
Amplifier Mode		
Deflection Factor		
Calibrated Steps	0.5 volts/division and 50 millivolts/division.	
Accuracy	Within 3%.	
Uncalibrated (Var) Range		At least 10:1.
Frequency Response		
Bandwidth (8 Div Reference)		
DC (Direct) Coupled	DC to at least 1 megahertz.	
AC (Capacitive) Coupled	50 hertz or less to at least 1 megahertz.	
Input		
Input R and C	1 megohm, within 2%, paralleled by less than 70 picofarads.	
Useful Input Voltage	+ and − 50 volts.	
Maximum Safe Input Voltage	350 volts (DC + Peak AC)	

SECTION 2
OPERATING INSTRUCTIONS

Introduction

The 5B10N Time Base/Amplifier Plug-In operates with a Tektronix 5100-series oscilloscope. An understanding of the 5B10N operation and capabilities is essential for obtaining best results. This section of the manual gives a brief functional description of the front-panel controls and connectors, a familiarization procedure, and general operating information.

PLUG-IN INSERTION AND REMOVAL

The 5B10N is calibrated and ready for use as it is received. It can be installed in any compartment of the 5100-series oscilloscope, but is intended for principal use in the horizontal (right) compartment. If the instrument is used in one of the vertical compartments (for example, to provide a vertical sweep), there is no retrace blanking; however, if used in the right vertical (center) compartment, internal triggering is provided.

To install, align the upper and lower rails of the 5B10N with the plug-in oscilloscope tracks and fully insert it (the plug-in panel must be flush with the oscilloscope panel). To remove, pull the release latch to disengage the 5B10N from the oscilloscope. Even though the horizontal gain of the oscilloscope is standardized to eliminate adjustment when inserting plug-in units, the sweep calibration of the 5B10N may be checked to verify measurement accuracy. The procedure for checking the unit is given under Sweep Calibration Check in this section.

CONTROLS AND CONNECTORS

This is a brief description of the function or operation of the front-panel controls and connectors. More detailed information is given under General Operating Information.

DISPLAY — Applies logic levels to the oscilloscope system to select CHOP (button pushed in) or ALTernate (button out) time-shared switching between vertical plug-ins and amplifier channels.

POSITION — Positions trace or display.

SECONDS/DIV OR VOLTS/DIV

Time-Base Mode — Time per major graticule division. Selects calibrated sweep rates from 1 μs/Div to 5 s/Div; 21 steps in a 1-2-5 sequence. Knob skirt is illuminated to provide sweep rate readout.

Amplifier Mode — Volts per major graticule division. Selects either of two calibrated deflection factors, 50 mV/Div or .5 V/Div, for external voltage signals. SWP MAG button must be out for correct deflection factor readout.

SWP MAG — Provides X10 magnification of the sweep; extends displayed sweep time per division to 100 nanoseconds/division. Knob-skirt readout illumination changes to MAG'D so magnified sweep rate can be read directly.

Variable Seconds/Div or Volts/Div — Provides uncalibrated, continuously variable sweep rate or deflection factor between calibrated steps. It extends sweep rate range to 12.5 s/Div, or deflection factor range to 5 V/Div.

TRIGGERING SOURCE — LEFT: Selects the left vertical plug-in as the trigger signal source.

RIGHT: Selects the right vertical plug-in as the trigger signal source.

COMPOSITE (both the LEFT and RIGHT buttons pushed in): Selects the signal being displayed as the trigger signal source.

	LINE: Selects line-frequency voltage as the trigger signal source.
	EXT: Selects EXT INPUT as the trigger signal source.
TRIGGERING LEVEL	Selects level of the triggering signal at which the sweep trigger is initiated.
TRIGGERING/ SWEEP MODE	AUTO TRIG: If triggering signal is absent or occurs at a rate less than 15 hertz, the sweep generator reverts to a free-running mode (bright baseline). Button out selects Normal Triggered Mode.
	AC COUPL: Button pushed in selects AC (capacitive) coupling of trigger and external signals. Button out selects DC coupling of trigger and external signals.
	+SLOPE: Button pushed in selects the positive slope of the triggering signal; button out selects the negative slope.
	SINGL SWP: Button pushed in selects the Single Sweep Mode, allowing sweep to be triggered only once until manually reset. Button out selects Normal Sweep Mode.
	RESET: Resets sweep circuits to accept next trigger when in the Single Sweep Mode. Terminates sweep if in process in both Normal and Single Sweep modes.
READY Indicator	Used in Single Sweep Mode to indicate when sweep circuit is triggerable.
EXT INPUT	Provides input for external trigger or signal input for external signals.

BASIC OPERATION

Preparation

The following information is provided to aid in quickly obtaining the correct control settings to present a time-base display. Operation of other instruments in the system is described in the instruction manuals for those units.

1. Insert the unit all the way into the oscilloscope right plug-in compartment.

2. Turn the oscilloscope Intensity control fully counterclockwise and turn the oscilloscope system Power ON.

3. Set the 5B10N front-panel controls as follows:

DISPLAY	ALT (button out)
POSITION	Midrange
SECONDS/DIV	1 ms
TRIGGERING	
LEVEL	Midrange
SOURCE	LEFT
MODE	AUTO TRIG, DC COUPL, +SLOPE, Normal Sweep (SINGL SWP button out)

4. Adjust the Intensity control for normal viewing of the trace.

Normal Sweep. The following procedure will provide a stable display for most normal sweep applications.

a. Select the TRIGGERING MODE switches which fit the requirements of the signal to be displayed.

b. To obtain a triggered display, turn the LEVEL control throughout its range until a stable display is achieved. If stable triggering cannot be achieved, either the triggering signal is inadequate or the TRIGGERING MODE switches are set incorrectly.

c. Set the SECONDS/DIV switch and POSITION control for desirable display. The Variable control should be in its detent position for calibrated sweep rates.

d. If the display does not start at the correct point on the waveform, readjust the LEVEL control to select the desired point.

Magnified Sweep. A magnified sweep display can be obtained as follows after a normal sweep display is obtained:

a. Change the SECONDS/DIV switch setting so the area to be magnified is within one graticule division (one-tenth of the sweep length). Use the POSITION control to move the area to be magnified to the center of the screen.

b. Push the SWP MAG button in. Note that the illuminated sweep rate changes by a factor of 10.

c. Use the POSITION control to estabilsh desired positioning of the magnified display.

Single Sweep Operation. This mode is similar to the normal modes, except that instead of a recurrent sweep, only one sweep can be produced until the sweep circuits are manually reset.

a. Obtain a normal triggered display, then push in the SINGL SWP button and temporarily disconnect the triggering signal from the oscilloscope.

b. Press the RESET button. The READY lamp should illuminate.

c. Re-apply the triggering signal to the oscilloscope. Observe that the READY light goes out and a single sweep occurs.

Amplifier Mode. To use the 5B10N in the amplifier mode, set the SECONDS/DIV or VOLTS/DIV switch to one of the two voltage positions. Apply a signal to the EXT INPUT connector. The AC – DC COUPL switch is operable to select coupling of the external signal; however,the remainder of the time-base mode switches are disabled. The display amplitude can be decreased by up to a factor of ten with the Variable control. Function of the POSITION control is the same as that for the time-base modes.

Sweep Calibration Check

The vertical and horizontal deflection systems of the 5100N-series oscilloscopes are gain-standardized to permit a plug-in to be moved from one oscilloscope to another (or from one compartment to another with the oscilloscope) without the need to recheck the calibration each time. However, the 5B10N timing can be checked and, if necessary, adjusted.

1. Connect the 2 X F_{LINE} calibrator signal from the oscilloscope Calibrator to the vertical plug-in unit input connector.

2. Set the SECONDS/DIV switch to 5 ms and adjust the TRIGGERING controls for a stable display. Be sure that the SWP MAG button is not pushed in.

3. Check the display for exactly 6 cycles of 120-hertz calibrator signal (or 5 cycles of 100-hertz signal for 50-hertz line) across the 10 divisions of the graticule.

4. If necessary, adjust the Timing potentiometer (internal adjustment) to provide the correct display.

GENERAL OPERATING INSTRUCTIONS

Triggering Source (A and B)

LEFT, RIGHT, or COMPOSITE. The LEFT and RIGHT buttons of the A and B TRIGGERING SOURCE switches permit selection of the triggering signal from either vertical plug-in unit. In addition, the A TRIGGERING SOURCE permits selection of the triggering signal from the signal being displayed (both LEFT and RIGHT buttons pushed in). This internal triggering normally provides the most convenient operation, because the sweep can be started at a selected point on a displayed signal.

NOTE

If the composite trigger mode is selected when this unit is installed in the 5403, the unit will trigger off the left vertical plug-in only.

LINE. When the LINE button is pressed, a sample of the power-line frequency is connected to the Trigger Preamplifier circuit. Line triggering is useful when the input signal is time-related to the line frequency. It is also useful for providing a stable display of a line-frequency component in a complex waveform.

EXT. An external signal connected to the EXT INPUT connector can be used to trigger the sweep when the EXT button is pressed. The external signal must be time-related to the displayed signal to produce a stable display. An external triggering signal can be used to provide a triggered display when the internal signal is too low in amplitude for correct triggering, or contains signal components on which it is not desired to trigger. It is also useful when signal tracing in amplifiers, phase-shift networks, wave-shaping circuits, etc. The signal from a single point in the circuit can be connected to the EXT INPUT connector through a signal probe or cable. The sweep is then triggered by the same signal at all times and allows examination of amplitude, time relationship, or wave-shape changes of signals at various points in the circuit without resetting the triggering controls.

Triggering Coupling

Two methods of coupling the triggering signal to the Trigger Preamplifier circuit can be selected. When the Coupling button is pushed in, AC COUPLing is selected, and when the button is out, DC coupling is selected.

The AC coupling capacitor blocks the DC component of the triggering signal. Low-frequency components below about 50 hertz are attenuated. In general, AC coupling can be used for most applications. However, if the triggering signal contains unwanted components or if the sweep is to

be triggered at a low repetition rate or a DC level, DC coupling should be used.

Trigger Slope

The SLOPE switch determines whether a sweep is initiated on the positive-going or negative-going portion of the triggering signal. When the button is pushed in (+ position), the display starts with the positive-going portion of the waveform; when the button is out (— position), the display starts with the negative-going portion of the waveform. When several cycles of a signal appear in the display, the setting of the SLOPE switch is often unimportant. However, if only a certain portion of a cycle is to be displayed, correct setting of the SLOPE switch is required to provide a display which starts on the desired slope of the input signal.

NOTE

When this plug-in is used in a Tektronix 5403 oscilloscope the leading edge of the display will not be observed when using sweep rates faster than 1 μs.

Triggering Level

The TRIGGERING LEVEL control determines the voltage level of the triggering signal at which the sweep is triggered. The + and — regions on the panel adjacent to the knob correspond to the more positive and more negative points on the triggering signal, or to the relative screen position when using an internal trigger source and DC coupling.

To set the LEVEL control, first select the TRIGGERING SOURCE, COUPLING, and SLOPE. Then set the LEVEL control fully counterclockwise and rotate it clockwise until the display starts at the desired point.

Sweep Mode

Normal Triggered Mode. The Normal Triggered Mode (AUTO TRIG button out) provides a repetitive triggered display when the LEVEL control is correctly set and an adequate triggering signal is available. Otherwise, the sweep generating circuits remain off and there is no display.

Auto Mode and Bright Baseline. Operation in this mode (AUTO TRIG button pushed in) provides a repetitive triggered display when the triggering signal is occurring at a rate of 15 hertz or greater and the LEVEL control is correctly set. When the trigger repetition rate is less than about 15 hertz, or in the absence of an adequate triggering signal, the Sweep Generator free runs at the sweep rate selected by the SECONDS/DIV switch to produce a reference trace. When an adequate triggering signal is again applied, the free-running condition ends and the Sweep Generator is triggered to produce a stable display.

Single Sweep Mode. When the SINGL SWP button is pushed in, operation is similar to the normal modes, except that only one sweep can be produced until manually reset. This mode can be used to photograph a non-repetitive signal. Also, when the signal to be displayed is not repetitive or varies in amplitude, shape, or time, use of the Single Sweep Mode eliminates the possibility of an unstable presentation.

To use the Single Sweep Mode, first make sure the Trigger Preamplifier circuit will respond to the event to be displayed. Set the SINGL SWP button for normal sweep (button out) and obtain the best possible triggered display in the normal manner (for random signals, set the LEVEL control so that the Trigger Preamplifier circuit will respond to a signal which is about the same amplitude as the random signal). Then push in the SINGL SWP button and press the RESET button to arm the sweep. This condition is indicated by the READY lamp, which lights when the sweep is ready to accept a trigger. The next trigger pulse initiates the sweep and a single trace will be presented on the screen. The READY light goes out immediately upon receipt of the sweep-initiating trigger. After the single sweep is terminated, the Sweep Generator is "locked out" until again reset. To prepare the circuit for another single-sweep display, press the RESET button again. Any sweep in progress when the RESET button is pressed is terminated, allowing the system to be quickly reset.

Selecting Sweep Rate

The SECONDS/DIV switch provides 21 calibrated sweep rates ranging from one microsecond per division to five seconds per division. The Variable control provides continuously variable sweep rates between the settings of the SECONDS/DIV switch, and extends the sweep rate range to about 12.5 seconds/division.

Sweep Magnification

The sweep magnifier expands the sweep ten times. One division of the unmagnified display is the portion visible on the screen when magnified. Equivalent length of the magnified sweep is about 100 divisions; any 10-division portion may be viewed by adjusting the POSITION control to bring the desired portion onto the viewing area.

To use sweep magnification, first move the portion of the display which is to be expanded to the center of the graticule. Then press the SWP MAG pushbutton. The knob-skirt readout changes by a factor of ten to provide a direct readout of the magnified sweep rate.

Amplifier Mode

In some applications, it is desirable to display one signal versus another (X-Y) rather than against time (Y-T). The

Amplifier Mode provides a means for applying an external signal to the horizontal amplifier for this type of display.

When the SECONDS/DIV or VOLTS/DIV switch is rotated counterclockwise into the VOLTS/DIV portion of the switch, the internal and line triggering inputs are grounded and the sweep generator circuit is disabled (including the CRT blanking gate). The external signal is routed through the amplifier portions of the circuitry and made available to the oscilloscope deflection system.

The external signals may be capacitive coupled (AC) or direct coupled (DC) by using the AC COUPL pushbutton; however, the remainder of the TRIGGERING switches and controls located within the green area on the front panel are disabled. Two calibrated deflection factors are provided; 50 millivolts/division and 0.5 volts/division. The Variable control provides a continuously variable 1X to 10X attenuation of the input signal.

Oscilloscope Applications

The 5100N Oscilloscope, including its associated display module and plug-in units, provides a very flexible measurement system. Specific applications for the individual plug-ins are described in the manuals for those units. Refer to the Operating Instructions section of the 5100N Oscilloscope System manual for the basic oscilloscope applications, including peak-to-peak AC voltage measurements, instantaneous DC voltage measurements, comparison measurements, time duration measurements, determining frequency, risetime measurements, and X-Y phase measurements.

REPACKAGING FOR SHIPMENT

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to the following table for carton test strength requirements.

2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.

3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.

4. Seal carton with shipping tape or industrial stapler.

SHIPPING CARTON TEST STRENGTH

Gross Weight (lb)	Carton Test Strength (lb)
0-10	200
10-30	275
30-120	375
120-140	500
140-160	600

NOTES

SECTION 3
CIRCUIT DESCRIPTION

Introduction

This section of the manual contains an electrical description of the circuits in the 5B10N Time Base/Amplifier plug-in unit. An overall block diagram and complete schematic diagrams are given on pullout pages at the rear of the manual.

BLOCK DIAGRAM DESCRIPTION

The Input Switching permits the sweep-triggering signal to be selected from any one of four sources. It also provides a choice of AC or DC coupling of triggering and display signals to the Trigger Preamplifier System. The Trigger Preamplifier serves two purposes: it provides current drive to initiate a trigger in the Sweep Logic portion of the Sweep Generator, and it provides a high-impedance input for the external-signal Amplifier.

The Sweep Generator circuit produces a sawtooth voltage which is amplified in the display unit to provide sweep deflection on the CRT. Positive- and negative-going gates are produced at the same time the sawtooth is being produced to perform sweep-related functions such as CRT sweep-retrace blanking, etc. The Sweep Generator can be operated in any one of several modes, including the normal triggered mode, the auto-triggered (bright baseline) mode, or the single-sweep mode.

The Amplifier allows an externally-applied signal to be displayed instead of a time-base sweep. For this mode of operation, the Trigger Preamplifier is used as a high-impedance input which permits both AC and DC coupling. The internal triggering inputs are grounded and the Sweep Generator is disabled (including the CRT blanking gate). The input attenuator permits selection of two deflection factors. The Amplifier has a X1 gain, and the Variable control provides a continuously variable 1X to 10X attenuation of the input signal.

The Position Driver provides positioning current for both time-base sweep signals and amplified signals. This stage is controlled by the front-panel POSITION control.

DETAILED CIRCUIT DESCRIPTION

A. Seconds/Div (Time Base) Mode

Display Switching

Alternate or Chopped time-shared switching of the vertical plug-ins and amplifier channels is selected at the time-base unit. The DISPLAY switch, S260, selects either CHOP (button pushed in) or ALT (button out).

Trigger Input

The source from which a sweep-triggering signal is obtained is selected by the TRIGGERING SOURCE switch, S110, which is a self-cancelling four-pushbutton switch. The triggering signal may be selected from internal, line, or external sources.

The internal triggering signal is obtained from either the left vertical plug-in, the right vertical plug-in, or from both as a composite triggering signal. Amplitude of the internal triggering signal is about 250 millivolts per division of display.

The line triggering signal is obtained from a network in the power supply circuit of the associated oscilloscope. A sample of the line frequency is applied via S110C to the input gate of Q128A.

External triggering signals applied to the EXT INPUT connector, J101, can be used to produce a trigger when the EXT button, S110D, is pushed in.

Trigger Coupling

The triggering signal may be capacitive coupled (AC COUPL) or direct coupled (DC). Coupling is selected by pushbutton switch S114. When the AC COUPL button is pressed, coupling capacitors C102 and C114 are placed in the circuit. These capacitors block any DC component of the signal while coupling signals of 50 hertz (−3 dB point) and higher to the input. When DC coupling is selected (button out), these capacitors are shorted, allowing the triggering signal to be direct-coupled to the gate of Q128A.

Trigger Preamplifier

Q128A, Q128B, Q132, and Q133 form a voltage comparator system to select the amplitude of a triggering signal at which a sweep trigger can be initiated. The triggering signal is applied to the gate of Q128A and a DC level established by R150, TRIGGERING LEVEL, is applied to the gate of Q128B. When the two halves of the comparator are balanced, the voltage at Q132 collector is zero and the current through R139 is zero. When the signal passes through the DC level, the conduction of the two halves of the comparator is shifted; and when the collector of Q132 moves away from zero volts (positive or negative) far enough to produce about 100 microamperes through R139, a trigger is initiated in U160.

Sweep Generator

The Sweep Generator circuit produces a linear sawtooth voltage which is used to provide sweep deflection in the associated oscilloscope. It also produces positive-going and negative-going gates to perform sweep-related functions such as time-shared switching and CRT unblanking in the oscilloscope.

The Sweep Generator circuit is composed of two integrated circuits, Sweep Logic U160 and Miller Integrator U210, and their associated discrete circuit components. The primary functions of these components are trigger slope selection and pulse forming, sawtooth start and stop, hold-off and single sweep lockout, and bright baseline generation. Table 3-1 discusses each terminal and its function. All terminals are digital unless noted otherwise, and positive logic is employed. Pins not used are grounded.

The Triggering and Sweep Mode switches, S170 and S171, allow three modes of operation: Normal Triggered Mode (AUTO TRIG button S170 out), Normal Auto and Bright Baseline Mode (AUTO TRIG button pushed in), and Single Sweep Mode (SINGL SWP button S171B pushed in). First to be discussed is the Normal Triggered Mode.

TABLE 3-1

SWEEP GENERATOR INPUT-OUTPUT

Sweep Logic U160

Terminal		Function
1	End Sweep	Current (logical 1) for at least 20 nanoseconds ends sweep. Current continuous locks out sweep. No input (logical 0) allows U160 to operate.
2	Not used	Grounded (chassis ground)
3	Not used	Grounded (chassis ground)
4	Trigger Input	Analog input, low impedance. Accepts analog current triggering signal. Trigger threshold: 0 current, ±100 μA.
5	Slope Select	Logical 1 permits trigger to be initiated on the positive slope of a triggering signal; logical 0 permits trigger to be initiated on the negative slope.
6	Single Sweep Control	Logical 1 permits repetitive sweep. Logical 0 allows only a single sweep to be produced unless reset (see pin 7).
7	Single Sweep Reset	Current into pin (logical 1) for at least 20 nanoseconds resets single sweep system and allows sweep to be retriggered. After reset occurs, C167 and R167 permit this input to return to ground (logical 0).
8	GND/Substrate	Provides ground reference for the device.
9	READY Lamp Output	Provides power (0.4 volt at a maximum of 80 mA) to READY lamp when sweep is ready for triggering (Single Sweep Mode). Removes power, extinguishing lamp upon receipt of sweep trigger. Open (+5 volts maximum) at other times.

TABLE 3-1 (cont)

Terminal		Function
10	Lockout	Logical 1—sweep is locked out (cannot be started). Logical 0—lockout off.
11	Holdoff Timing	Connects timing components which set trigger lockout period after end of sweep. Capacitor discharges as soon as sweep is started, and timing starts at end of sweep as capacitor charges. When capacitor charges to upper threshold (+3.5 volts), new sweep can be produced either upon receipt of next trigger or if pin 12 is above its upper threshold (see pin 12).
12	Bright Baseline Timing/Off	Used in Auto Triggered Mode to connect timing components which set bright baseline off period after trigger recognition. If triggering signal is absent or occurring at a rate less than 15 hertz, capacitor charges toward +3.5-volt threshold. Above this level, U160 is conditioned to provide a free running sweep at a rate determined by the sweep timing and holdoff RC. As soon as a trigger arrives at pin 4 of U160, pin 12 is driven to ground and C179 is discharged.
13	Bright Baseline Control	Current into pin (logical 1) for ⩾20 nanoseconds keeps pin 12 at ground, holding Bright Baseline off. Baseline remains off for one timing period after current level is removed. No input (logical 0) allows Bright Baseline to function (see pin 12).
14	+ Gate Output	Provides a +5-volt source through 2 kilohms (logical 1) during sweep, driving current into pin 1 of U210. Logical 0 (+0.4 volt at 5 mA maximum) when sweep is not being produced. Maximum delay after fast-rise trigger initiation is 30 nanoseconds.
15	− Gate Output	Logical 0 (+0.4 volt at 5 mA maximum) during sweep. Provides a +5-volt source through 2 kilohms (logical 1) when sweep is not being produced. Maximum delay after fast-rise trigger initiation is 25 nanoseconds.
16	Power Supply	Supply voltage of +5 volts is applied.

Miller Integrator U210

Terminal		Function
1	Sweep Gate In	Current into pin results in sawtooth voltage at pin 8.
2	Oscillation Suppressor	Connects discrete components to prevent oscillation of the Miller Integrator.
3	Ground	Provides ground reference to the device.
4	End Sweep Pulse	Drives current into pin 1 of U160 to terminate sweep.
5	Not used	Function blocked.
6	End Sweep Level	Connects voltage divider to a reference comparator inside the device, establishing the level at which the sweep sawtooth is terminated.
7	Power Supply	Supply voltage of +15.5 volts applied.
8	Sawtooth Output	Produces sweep sawtooth voltage when current is gated into pin 1. Sawtooth is positive going, with amplitude of 0 to +10 volts.
9	Timing Current Input	Connects timing components which determine sweep rate.
10	Substrate	Supply of 16 milliamperes applied.

Normal Triggered Mode

The Trigger Preamplifier circuit provides current drive to pin 4 of U160 at selected levels on both the positive- and negative-going slopes of the triggering signal. The SLOPE switch, S171A, controls the level at pin 5 to determine the slope at which the sweep trigger is initiated.

When the trigger is inititated in U160, a positive transition occurs at pin 14. This output will remain high until the sweep terminates. At the same time, a negative gate is produced at pin 15 which is used to unblank the CRT in the oscilloscope.

Integrated circuit U210 is a Miller Integrator, a type of operational amplifier in which the feedback element is the timing capacitor. Before a positive gate is received from U160, timing capacitor C224, C225, or C229 has essentially no charge, as it is clamped by a network inside U210, and current through the timing resistor network R225-R238 is input to pin 9 of U210. When the positive gate arrives from U160, the current is switched into the timing capacitor and it begins to charge. The current is nearly constant, and since pin 9 is the operational amplifier null point, a linearly increasing voltage (sawtooth) is produced at pin 8. The rate of the sawtooth rise is a function of the constant current through the timing resistors and the capacitance of C224, C225, or C229.

The voltage at pin 8 of U210 continues to go positive until it reaches the level set at pin 6 by voltage divider R208-R209. At this point, a reference comparator inside U210 produces a current output at pin 4, which is conducted through CR219 to pin 1 of U160, causing the outputs at pins 14 and 15 to revert to original states. With the positive voltage removed at pin 1 of U210, the timing capacitors discharge into pin 9 and the sweep terminates.

A short-duration trigger-lockout period (to allow the sweep circuits to stabilize when the sweep terminates) is provided by the holdoff network at pin 11 of U160. For U160 to function, the voltage at pin 11 must be at least +3.5 volts. When the sweep starts, the voltage at pin 11 is driven to ground, discharging holdoff capacitors C154, C155, or C156. The capacitors begin to charge as the sweep progresses, and continue to charge as the sweep terminates. The time between sweep termination and that at which pin 11 reaches the +3.5-volt threshold is the holdoff period.

The timing and holdoff RC components are selected by the SECONDS/DIV switch, S160. The Timing potentiometer, R238, allows calibration of this circuit for accurate timing when the Variable control, R235A, is in the CAL detent position. The Variable control provides uncalibrated, continuously variable timing.

Normal Auto Triggered Mode and Bright Baseline Operation

Operation of the Sweep Generator in the Normal Auto Triggered Mode is the same as that described for the Normal Triggered Mode when a trigger is present and occurring at a rate greater than 15 hertz. However, when a trigger is not present within a specified time, a free-running reference trace, or Bright Baseline, is produced. This is accomplished as follows:

When the AUTO TRIG button is pushed in, R172 is disconnected from +5 volts, removing the Bright Baseline lockout current from pin 13 of U160. This allows the Bright Baseline timing circuit R179-C179 to function. Each time a trigger is initiated in U160, pin 12 is driven to ground and C179 is discharged. C179 immediately begins to charge again. If the capacitor is allowed to charge above the +3.5-volt threshold level, U160 is conditioned to provide a positive gate at pin 14 and a negative gate at pin 15 as soon as the holdoff period is completed (when pin 11 rises above its threshold). The sweep will therefore free run at a rate determined by the timing and holdoff networks.

Single Sweep Mode

Operation of the Sweep Generator in the Single Sweep Mode is similar to operation in the Normal Triggered Mode. However, after one sweep has been produced, further triggers are locked out in U160 until the RESET button is pressed.

When SINGL SWP button S171B is pushed, the following conditions are established in U160: +5 volts is applied to R173 to drive current into pin 13, keeping pin 12 at ground and holding the Bright Baseline feature off. Pin 6 is grounded, requiring U160 to be manually reset. The READY lamp, DS270, is connected to pin 9 to indicate that the system is reset and triggerable. As soon as the system is triggered, the READY lamp is extinguished.

The system is reset when RESET button S171C is pushed. +5 volts is applied to differentiating networks C162-R162 and C167-R167. The positive spike appearing at pin 1 terminates any sweep that is in progress and the spike appearing at pin 7 resets the system.

Sweep Magnification and Positioning

A X10 magnification of the sweep is achieved by changing the attenuation ratio of the output sawtooth. For an unmagnified sweep, R241, R243, and R244 provide a 20X attenuation of the sawtooth, reducing it from a +10-volt amplitude to a +0.5-volt amplitude. The deflection sensitivity of the associated oscilloscope is such that this amplitude will give one screen width of deflection, provided that the 5B10N output sawtooth is centered about ground, which corresponds with screen center.

When the SWP MAG button, S240, is pressed, R243 is disconnected, changing the attenuation to 2X and increasing the sawtooth amplitude to 5 volts. Since only one-tenth of this amplitude is accepted by the oscilloscope, the displayed segment appears as a X10 magnification. Also, the knob-skirt readout is changed by a factor of 10 (DS248 turns off and DS249 lights) to indicate the magnified sweep rate.

R245, POSITION, provides an adjustable change in the conduction of Q246 to alter the DC level of the output signal. Positioning range is sufficient to move any portion of a magnified sweep into the on-screen window.

B. Volts/Div (Amplifier) Mode

General

To operate the instrument in the amplifier mode, the SECONDS/DIV switch is rotated counterclockwise into one of the two VOLTS/DIV positions. In this condition, the internal and line triggering inputs are grounded, the sweep generator circuit is disabled (including the CRT blanking gate), and the output of the Trigger Preamplifier is connected through a grounded base amplifier and made available to output pins A7 and A13.

Signal Input

External voltage signals to be displayed are applied to the EXT INPUT connector. These signals may be capacitive coupled (AC COUPL) or direct coupled (DC). Coupling is selected by pushbutton switch S114. When the AC COUPL button is pressed, C102 is placed in the circuit to couple signals of about 50 hertz (−3 dB point) and higher to the input. C102 blocks any DC component of the signal. When the button is out (DC), capacitor C102 is shorted and the signal is direct-coupled to the input.

The signal by-passes the triggering source inputs via the closed contacts of the VOLTS/DIV switch; in the 50 mV/DIV position, the signal is passed directly to the gate of Q128A and in the 500 mV/DIV position, the signal is passed through a frequency-compensated 10X divider to the gate of Q128A.

Input Stage

Q128A, Q128B, Q132, and Q133 form a non-inverting operational amplifier which is operated as a unity-gain voltage follower to isolate the amplifier stage from the high impedance input circuitry. As a signal is applied to the gate of Q128A, an in-phase signal of essentially the same amplitude is produced at the collector of Q132. The TRIGGERING LEVEL potentiometer, R150, is disconnected from the gate of Q128B, allowing the gain of the stage to be determined by the ratio of R135 and R136.

Output Stage

The output from the collector of Q132 is connected to the emitter circuit of Q144, which is a grounded-base amplifier. The signal produced at the Q144 collector is in phase with the applied signal. Gain of the stage is about one with the Variable Volts/Div potentiometer, R235B, in the detent position. As R235B is varied, more resistance is added to the emitter circuit, decreasing the gain. The output signal is made available to the deflection system of the associated oscilloscope through pins A7 and A13 of the plug-in connector.

C. Time-Base and Deflection Factor Switching

The SECONDS/DIV OR VOLTS/DIV switch, S160, is made up of a series of cam lobes which engage and disengage various contacts at different positions of the switch. The switch selects any of 21 calibrated sweep rates from 1 μs/DIV to 5 s/DIV, or either of two calibrated deflection factors, 50 mV/div or 500 mV/DIV, for external voltage signals.

Either of two lamp bulbs located behind the knob skirt of the switch illuminates the selected rate to provide a direct readout. Normally, DS248, which is physically located behind the upper right portion of the knob skirt, is lit. Pushing the SWP MAG button automatically changes the readout by a factor of 10 (i.e., turns off DS248 and lights DS249).

Table 3-2 lists the function of each switch contact. Those contacts that are engaged at any given position of the switch are shown by black dots on the switch logic portion of the schematic diagram.

TABLE 3-2

Contact	Function
1-6	Input switching.
7, 8	Trigger Preamplifier output switching.
9	Connects/disconnects Triggering Level control.
10	Sweep enable/disable.
11, 12	Holdoff timing RC switching.
13	Blanking gate enable/disable.
14-20	Sweep timing RC switching.
21, 22	Time-base or amplifier output selection.

NOTES

SECTION 4
CALIBRATION

Introduction

This section of the manual contains a procedure to return the circuits of the 5B10N to within their designed operating capabilities. Calibration is generally required after a repair has been made, or after long time intervals in which normal aging of components may affect instrument accuracy. For initial inspection to verify instrument operation, the Basic Operation procedure in Section 2 should be used (the instrument is checked with its covers on, using a minimum of peripheral equipment).

Instrument Maintenance

Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Maintenance section of the Oscilloscope System manual. Also, the system manual contains information for general maintenance of this instrument, including preventive maintenance, component identification and replacement, etc.

Services Available

Tektronix, Inc. provides complete instrument repair and calibration at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

TEST EQUIPMENT REQUIRED

General

The following test equipment and accessories, or the equivalent, is required for complete calibration of the 5B10N. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, some of the specifications listed here may be less rigorous than the actual performance capabilities of the test equipment. All test equipment is assumed to be correctly calibrated and operating within the listed specifications.

Calibration Equipment Alternatives

If other test equipment is substituted, control settings or calibration setup may need altering to meet the requirements of the equipment used. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

Special Calibration Fixtures

Special Tektronix calibration fixtures are used in this procedure only where they facilitate instrument calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

Test Instruments

1. 5100N-series oscilloscope. For this procedure, a 5103N/D10 with a 5A15N amplifier is used.

2. Time-base unit. In addition to the 5B10N being calibrated, a second unit is required to generate a vertical sweep when checking the amplifier mode. Any 5B10-series time-base will suffice.

3. Constant-amplitude sine-wave generator. Frequency, 2 hertz to 2 megahertz; output amplitude, from about 0.5-volt to greater than 20 volts peak to peak. For example, General Radio 1310-B Oscillator (use a GR Type 274 QBJ Adapter to provide BNC output).

4. Time-mark generator. Marker outputs, 0.1 microsecond to 5 seconds; marker accuracy, within 0.1%. Tektronix 2901 Time Mark Generator recommended.

5. Standard amplitude calibrator. Required only for checking amplifier mode. Frequency, about 1 kilohertz; square-wave output amplitude, 0.5 volt to 5 volts, within 0.25%. Tektronix Calibration Fixture 067-0502-01 recommended.

Accessories

6. Coaxial cable. Impedance, 50 ohms; length, 42 inches, connectors, BNC. Tektronix Part No. 012-0057-01.

7. Dual-input cable. Provides matched signal paths to the vertical and time-base external inputs. Tektronix Calibration Fixture 067-0525-00 recommended.

SHORT-FORM PROCEDURE AND INDEX

5B10N Serial No. ______________________

Calibration Date ______________________

Calibrated By ______________________

Triggering Sensitivity: Check that triggering circuit is sensitive to the signals given in Table 4-1, with the input conditions as listed.

Triggering Level Control Range: Range is at least + and −5 volts for external signals.

Line Triggering Operation: Stable CRT display at line frequency.

Sweep Timing: At 2 ms/div sweep rate, adjust R238 (Timing) for two 1-millisecond markers per major graticule division.

Seconds/Div Switch Accuracy: Timing accuracy for all switch positions is as listed in Table 4-2.

Sweep Length: Between 10 and 11 major divisions.

Variable Seconds/Div Ratio: Ratio is at least 2.5:1.

Positioning Range: Any portion of the sweep can be positioned on screen.

Single Sweep Operation: Single sweep operation and triggering is verified.

Magnifier Registration: Registration between unmagnified and magnified sweeps is two divisions or less.

Amplifier Gain and Variable Attenuation Ratio: Accuracy of indicated deflection factor is within 3%. Variable attenuation ratio is at least 10:1.

Attenuator Compensation: Adjust C104 for best square-wave display.

Amplifier Bandwidth: Bandwidth is DC to 1 megahertz for DC-coupled input, 50 hertz to 1 megahertz for AC-coupled input.

CALIBRATION PROCEDURE

Preparation

NOTE

This instrument should be adjusted at an ambient temperature between +20°C and +30°C (between +68°F and +86°F) for best overall accuracy.

1. Remove the dust cover from the right side of the 5B10N and remove the cabinet panel from the 5100-series oscilloscope. Insert the 5B10N into the right plug-in compartment and insert a 5A-series amplifier unit into the center plug-in compartment. A plug-in extender (Part No. 067-0645-00) is available for use with this system, but is not mandatory for this procedure.

2. Connect the oscilloscope to the power source for which it is wired. Set the controls as given under Initial Control Settings.

Initial Control Settings

NOTE

Do not preset internal controls unless they are known to be significantly out of adjustment, or unless repairs have been made in the circuit. In these instances, the particular controls can be set to midrange.

5B10N

DISPLAY	ALT (button out)
POSITION	Midrange
SECONDS/DIV	1 millisecond
Variable	CAL (fully clockwise)
SWP MAG	Off (button out)
Triggering	
LEVEL	Midrange
SOURCE	RIGHT
MODE	AUTO TRIG, DC COUPL, +SLOPE, Normal Sweep (SINGLE SWP button out)

Oscilloscope

Mainframe (5103N/D10)	
Intensity	Normal display brightness
Focus	Adjust for best focus of trace
Amplifier (5A15N)	
Display	On
Position	Midrange
Volts/Div	0.5 V
Variable Volts/Div	Calibrated (fully clockwise)
Input Coupling	DC

1. Check Sweep Triggering

TRIGGERING SENSITIVITY

a. Connect the sine-wave generator output to the amplifier input and to the 5B10N EXTERNAL INPUT through a coaxial cable and a dual-input cable. Set the generator for a two-megahertz, 0.6-division (300 millivolts) display. Position the display as desired.

b. CHECK—Using the conditions and control settings given in Table 4-1 as a guide, check that stable triggering can be obtained with the LEVEL control.

TRIGGERING LEVEL CONTROL RANGE

c. Change the following control settings:

SECONDS/DIV	1 ms
Coupling	DC
Volts/Div	5 V

d. Temporarily disconnect the sine-wave generator signal and adjust the free-running trace to the center graticule line. Reconnect the signal and adjust the sine-wave frequency to one kilohertz and the amplitude to slightly greater than two divisions.

e. CHECK—For both AC and DC coupling, stable CRT displays can be obtained with the LEVEL control, selecting any point on the triggering signal within the center two divisions to start the display. This indicates a level range of + and −5 volts for external signals.

f. Disconnect the sine-wave generator.

LINE TRIGGERING OPERATION

g. Set the SECONDS/DIV switch to .1 m.

h. CHECK—Push in the LINE Source button and note that the trace dims. Rotate the LEVEL control throughout its range, observing that the trace brightens at each extreme of the range. When triggered, the trace dims because it is recurring at a slower rate than the free-running auto baseline.

i. Change the Coupling to DC, and the SECONDS/DIV to 2 ms.

2. Check/Adjust Sweep Generator

If you are beginning calibration with this step, set the front-panel controls as listed under Initial Control Settings, except as follows:

SEC/DIV	2 ms

TABLE 4-1

Sine-wave generator frequency	SECONDS/DIV	Triggering Coupling	Triggering Source	Triggering Slope	Triggering signal display amplitude
2 MHz	1 μs	DC	RIGHT	+, −	0.6 div (0.4 div to 1 MHz)
			EXT	+, −	0.4 div (200 mV)
		AC	RIGHT	+, −	0.6 div (0.4 div to 1 MHz)
			EXT	+, −	0.4 div (200 mV)
50 Hz	10 ms	DC[1]	RIGHT	+, −	0.4 div
			EXT	+, −	0.4 div (200 mV)
		AC	RIGHT	+, −	0.4 div
			EXT	+, −	0.4 div (200 mV)

[1] The sine-wave generator can be adjusted toward DC (zero hertz) with no loss in triggering if the specified display amplitude is maintained.

SWEEP TIMING

a. Connect the time-mark generator marker output to the vertical input connector through a coaxial cable. Set the time-mark generator for 1-millisecond markers. If necessary, adjust the Volts/Div switch to provide about two divisions or more of marker amplitude.

b. Check—Two 1-millisecond markers per major graticule division.

ADJUST—R238, Timing, so the third and nineteenth 1-millisecond markers coincide with the first and ninth graticule lines and are thus exactly 8 divisions apart (sweep timing accuracy is measured over the middle 8 graticule divisions).

SECONDS/DIV SWITCH ACCURACY

c. Set the SECONDS/DIV switch and time-mark generator marker selector as per Table 4-2. Check timing accuracy over the middle 8 divisions.

TABLE 4-2

SECONDS/DIV switch setting	Time marker selector	CRT display (Markers/division)	Accuracy (measured between second and ninth graticule lines)
.1 μ	.1 μs	1	Magnified sweep: ±4% (0.32 div)
.2 μ	.1 μs	2	
.5 μ	.5 μs	1	
1 μ	1 μs[2]	1	Normal sweep: ±3% (0.24 div) Magnified sweep: ±4% (0.32 div) NOTE: No magnification at 1 sec/div or slower sweep rates.
2 μ	1 μs	2	
5 μ	5 μs	1	
10 μ	10 μs	1	
20 μ	10 μs	2	
50 μ	50 μs	1	
.1 m	.1 ms	1	
.2 m	.1 ms	2	
.5 m	.5 ms	1	
1 m	1 ms	1	
2 m	1 ms	2	
5 m	5 ms	1	
10 m	10 ms	1	
20 m	10 ms	2	
50 m	50 ms	1	
.1	.1 s	1	
.2	.1 s	2	
.5	.5 s	1	
1	1 s	1	
2	1 s	2	Normal sweep: ±4% (0.32 div) Magnified sweep: ±5% (0.4 div)
5	5 s	1	

[2]In some cases, fast transient signals such as 1 μs markers may exceed the bandwidth of the amplifier and result in a distorted display. If the amplifier meets the specifications listed in Section 1 of the 5A-series amplifier manual, no maintenance problem exists.

d. CHECK—Normal and magnified sweep accuracies are as specified in Table 4-2.

SWEEP LENGTH

e. Change the SECONDS/DIV switch to 1 ms and set the time-mark generator for 1-millisecond markers. While observing the eleventh 1-millisecond marker (at the extreme right edge of the graticule), position the display horizontally so the end of the sweep can be seen.

f. CHECK—Sweep length is between 10 and 11 major divisions.

NOTE

This tolerance is provided as a guide to correct instrument operation and is not an instrument specification.

g. Reposition the sweep start to the left edge of the graticule.

VARIABLE SECONDS/DIV RATIO

h. Set the time-mark generator for 10-millisecond markers. Slowly turn the Variable control to its full counterclockwise position. Change in timing should be smooth over the entire range of the control.

i. CHECK—CRT display for 4 divisions or less of spacing between time markers (2.5:1 ratio).

j. Return the Variable control clockwise to its CAL detent.

POSITIONING RANGE

k. Rotate the POSITION control from one extreme to the other.

l. CHECK—Both ends of the sweep can be positioned on screen. The sweep start should be positionable to within 1 division of the graticule center.

m. Reposition the sweep start to the left edge of the graticule.

SINGLE SWEEP OPERATION

n. Temporarily disconnect the time-marker signal and push in the SINGL SWP button.

o. Push the RESET button and check that the READY lamp illuminates.

p. CHECK—Re-apply the signal to the vertical input. The READY lamp must extinguish as the sweep is triggered and a single sweep must occur.

MAGNIFIER REGISTRATION

q. Set the Sweep Mode to normal sweep (SINGLE SWP button out) and set the time-mark generator for 5-millisecond markers.

r. Adjust the POSITION control, if necessary, so the middle marker coincides exactly with the graticule vertical center line. Push in the SWP MAG button.

s. CHECK—Magnified 5-millisecond marker is within two divisions of graticule center.

NOTE

Magnifier registration is a mainframe adjustment. To adjust for minimum shift of marker when switching from unmagnified to magnified sweep, refer to the Horizontal Centering/Magnifier Registration step of the calibration procedure in the Display Unit manual.

t. Release the SWP MAG button.

u. Disconnect the time-mark generator.

3. Check/Adjust External-Signal Amplifier

AMPLIFIER GAIN and VARIABLE ATTENUATOR RATIO

a. Set the SECONDS/DIV or VOLTS/DIV switch to 50 mV. Check that DC coupling is selected. Plug a second time-base unit into the left plug-in compartment and establish a 0.5-millisecond/division free-running vertical sweep.

b. Connect the standard amplitude calibrator output to the EXT INPUT connectors of both time-base units through a coaxial cable and a dual-input cable. Set the calibrator for a 0.5-volt square-wave output.

c. Adjust the vertical time-base unit triggering controls for an externally triggered square-wave display. Adjust the 5B10N POSITION control so the left edge of the display coincides with the left edge of the graticule.

d. CHECK—Horizontal amplitude is 10 divisions, ±0.3 division (±3%).

e. Rotate the Variable Volts/Div control fully counterclockwise.

f. CHECK—Horizontal amplitude is 1 division or less (10:1 ratio).

g. Return the Variable control clockwise to its CAL detent.

h. Set the VOLTS/DIV switch to .5 V and the calibrator for a 5-volt square-wave output.

i. CHECK—Horizontal amplitude is 10 divisions. ±0.3 division (±3%).

ATTENUATOR COMPENSATION

j. ADJUST—C104 for best square-wave display (minimum rolloff or overshoot of leading edge).

AMPLIFIER BANDWIDTH

k. Disconnect the signal cable from the standard amplitude calibrator output and connect it to the constant-amplitude sine-wave generator output. Adjust the sine-wave generator for eight horizontal divisions of 1-kilohertz display as a reference. Adjust positioning as necessary. Then slowly increase the frequency until the display amplitude is 5.66 divisions. This is the upper −3 dB point.

l. CHECK—Frequency at the upper −3 dB point must be at least 1 megahertz for a DC-coupled input.

m. Push in the AC COUPL button and repeat step k.

n. CHECK—Frequency at the upper −3 dB point must be at least 1 megahertz for an AC-coupled signal.

o. Adjust the sine-wave generator for eight horizontal divisions of 1-kilohertz display, then slowly decrease the frequency until the display amplitude is 5.66 divisions. This is the lower −3 dB point, AC coupled.

p. CHECK—Frequency at the lower −3 dB point is 50 hertz or less.

q. Disconnect the sine-wave generator.

This completes the calibration procedure for the 5B10N Time Base/Amplifier unit.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

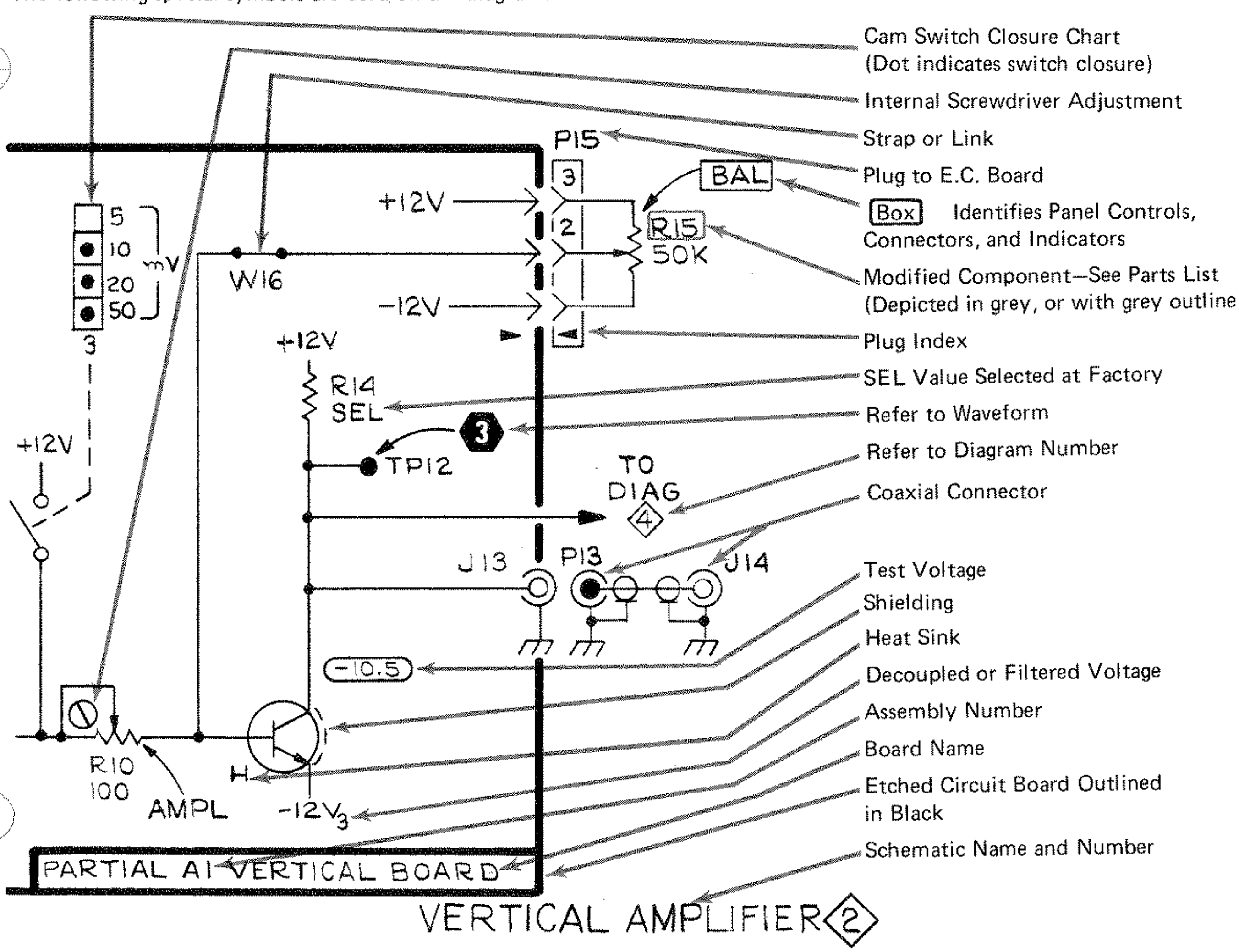
Symbols used on the diagrams are based on ANSI Standard Y32.2-1975.

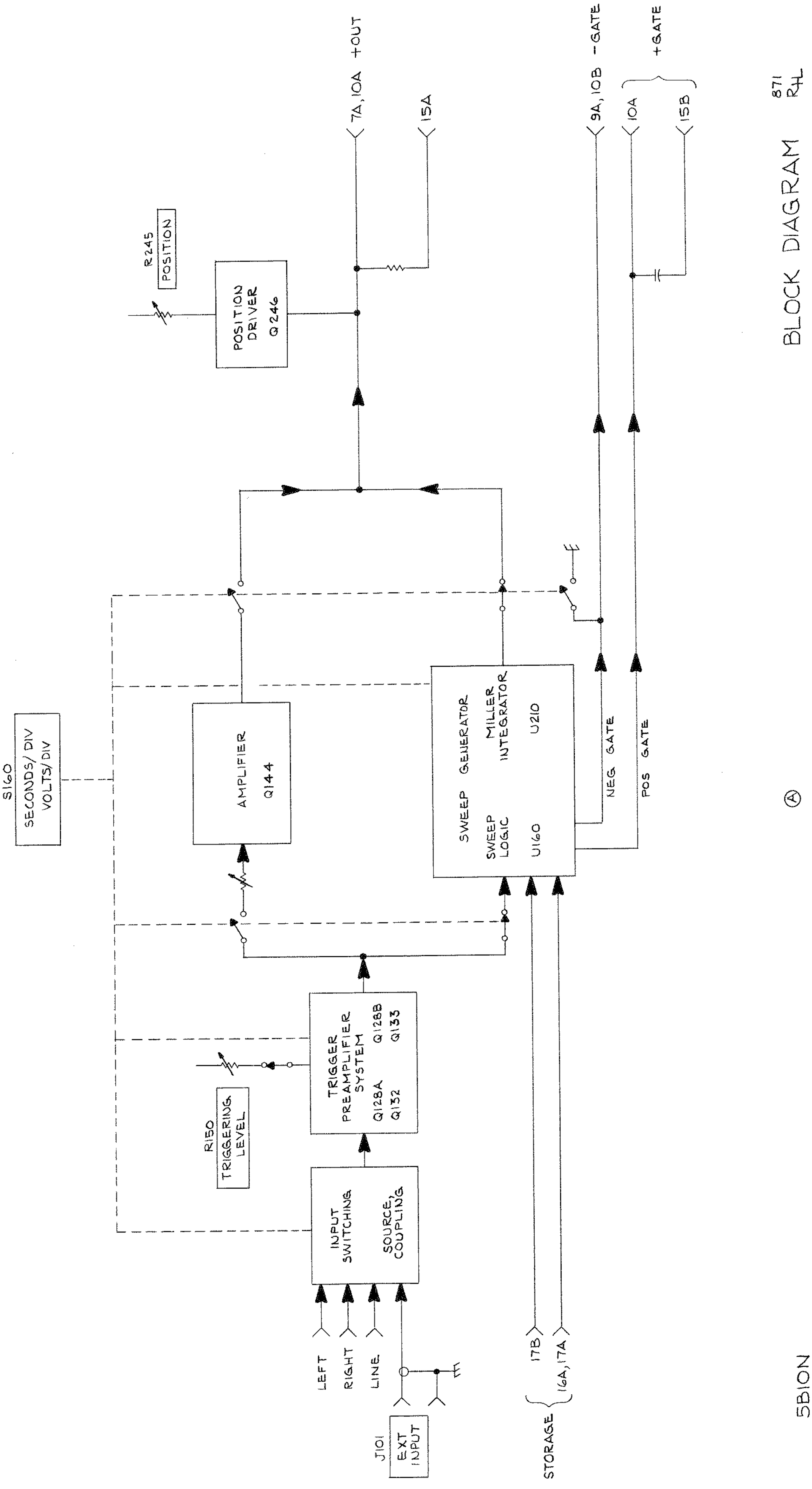
Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CB	Circuit breaker
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
E	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
HY	Hybrid circuit
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
M	Meter
P	Connector, movable portion
Q	Transistor or silicon-controlled rectifier
R	Resistor, fixed or variable
RT	Thermistor
S	Switch or contactor
T	Transformer
TC	Thermocouple
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
W	Wirestrap or cable
Y	Crystal
Z	Phase shifter

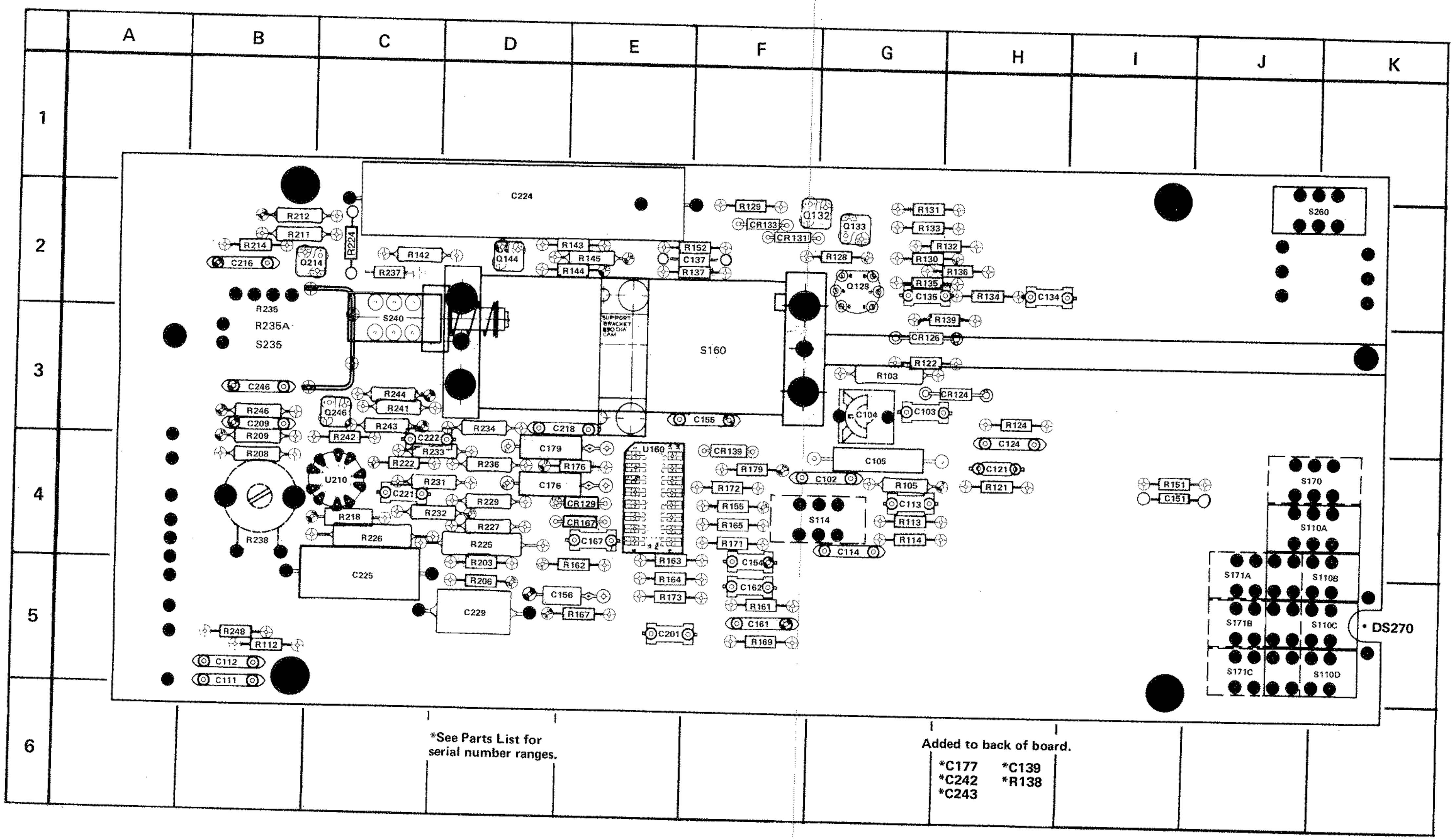
The following special symbols are used on the diagrams:





BLOCK DIAGRAM
5B10N
J101 EXT INPUT
LEFT
RIGHT
LINE
INPUT SWITCHING
SOURCE, COUPLING
R150 TRIGGERING LEVEL
TRIGGER PREAMPLIFIER SYSTEM
Q128A Q132
Q128B Q133
S160 SECONDS/DIV VOLTS/DIV
AMPLIFIER Q144
SWEEP GENERATOR
SWEEP LOGIC U160
MILLER INTEGRATOR U210
NEG GATE
POS GATE
STORAGE
17B
16A, 17A
POSITION DRIVER Q246
R245 POSITION
7A, 10A +OUT
15A
9A, 10B -GATE
10A
15B
+GATE

5B10N PARTS LOCATION GRID



CKT NO	GRID LOC
C102	G-4
C103	G-3
C104	G-3
C105	G-4
C111	B-5
C112	B-5
C113	G-4
C114	G-4
C121	H-4
C124	H-3
C134	H-2
C135	H-2
C137	F-2
C151	I-4
C154	F-4
C155	F-3
C156	E-5
C161	F-5
C162	F-5
C167	E-4
C176	D-4
C179	D-4
C210	E-5
C209	B-3
C216	B-2
C218	E-3
C221	C-4
C222	C-4
C224	D-2
C225	C-5
C229	D-5
C246	B-3
CR124	H-3
CR126	G-3
CR129	E-4
CR131	F-2
CR133	F-2
CR139	F-4
CR167	E-4
DS270	K5
Q128	G-2
Q132	F-2
Q133	G-2
Q144	D-2
Q214	B-4
Q246	C-3
R103	G-3
R105	G-4
R112	B-5
R113	G-4
R114	G-4
R121	H-4
R122	G-3
R124	H-3
R128	G-2
R129	F-2
R130	G-2
R131	G-2
R132	G-2
R133	G-2
R134	H-2
R135	G-2
R136	H-2
R137	F-2
R139	H-2
R142	C-2
R143	E-2
R144	E-2
R145	E-2
R151	I-4
R152	F-2
R155	F-4
R161	F-5
R162	E-5
R163	E-4
R164	E-5
R165	F-4
R167	E-5
R169	F-5
R171	F-4
R172	F-4
R173	E-5
R176	E-4
R179	F-4
R203	D-5
R206	D-5
R208	B-4
R209	B-4
R211	B-2
R212	B-2
R214	B-2
R218	C-4
R222	C-4
R224*	C-2
R225	D-4
R226	C-4
R227	D-4
R229	D-4
R231	C-4
R232	C-4
R233	C-4
R234	D-3
R235	B-3
R235A	B3
R236	D-4
R237	C-2
R238	B-4
R241	C-3
R242	C-4
R243	C-3
R244	C-3
R246	B-3
R248	B-5
S110A	K-4
S110B	K-4
S110C	K-5
S110D	K-5
S114	G-4
S160	C-3
S170	K-4
S171A	J-5
S171B	J-5
S171C	J-5
S235	B3
S240	E-3
S260	K-2
U160	E-4
U210	C-4

REV. D FEB 1977

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MURTLE BEACH, SC 29577
05091	TRI-ORDINATE CORPORATION	343 SNYDER AVENUE	BERKELEY HEIGHTS, NJ 07922
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
53944	ELT INC., GLOW LITE DIVISION	BOX 698	PAULS VALLEY, OK 73075
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71450	CTS CORP.	1142 W. BEARDSLEY AVE.	ELKHART, IN 46514
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
72136	ELECTRO MOTIVE CORPORATION, SUB OF INTERNATIONAL ELECTRONICS CORPORATION	SOUTH PARK AND JOHN STREETS	WILLIMANTIC, CT 06226
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

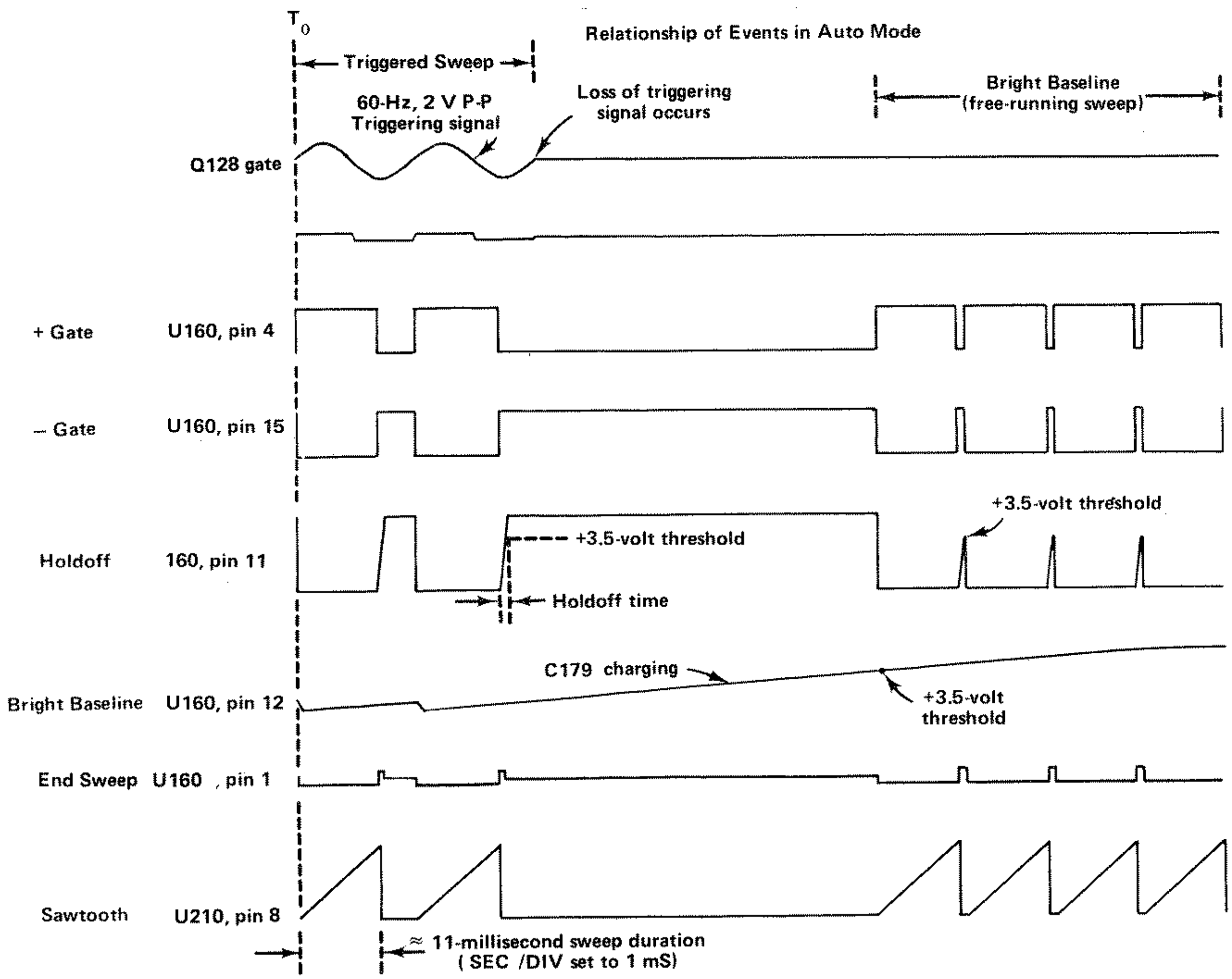
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-1345-00	B010100	B079999	CKT BOARD ASSY:MAIN	80009	670-1345-00
A1	670-1345-01	B080000		CKT BOARD ASSY:MAIN	80009	670-1345-01
C102	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C103	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C104	281-0078-00			CAP.,VAR,AIR DI:1.4-7.5PF,800V	72982	542-002
C105	283-0543-00			CAP.,FXD,MICA D:250PF,5%,500V	72136	CM20F251J
C111	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C112	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C113	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C114	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C121	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C124	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C134	281-0625-00			CAP.,FXD,CER DI:35PF,5%,500V	72982	308-000C0G0350J
C135	281-0524-00			CAP.,FXD,CER DI:150PF,+/-30PF,500V	04222	7001-1381
C137	281-0562-00	XB030000		CAP.,FXD,CER DI:39PF,10%,500V	72982	301-000U2J0390K
C139	281-0543-00	XB076059		CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C151	283-0002-00	XB030000		CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C154	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C155	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C156	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	162D105X0035CD2
C161	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C162	281-0524-00			CAP.,FXD,CER DI:150PF,+/-30PF,500V	04222	7001-1381
C167	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C176	290-0134-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	150D226X0015B2
C177	281-0543-00	XB050000		CAP.,FXD,CER DI:270PF,10%,500V	72982	301055X5P271K
C179	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C201	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C209	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C216	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C218	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
C221	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C222	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C224, C225, C229 [1]	295-0143-00			CAP.,SET,MTCHD:10UF,0.1UF,0.001UF (10UF / 0.001UF)	80009	295-0143-00
C242	281-0549-00	XB050000		CAP.,FXD,CER DI:68PF,10%,500V	72982	301-000U2J0680K
C243	281-0546-00	XB060000		CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C246	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
CR124	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR126	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR129	152-0185-00			SEMICOND DEVICE:SILICON,40PIV,150MA	07910	1N4152
CR131	152-0185-00			SEMICOND DEVICE:SILICON,40PIV,150MA	07910	1N4152
CR133	152-0185-00			SEMICOND DEVICE:SILICON,40PIV,150MA	07910	1N4152
CR139	152-0185-00			SEMICOND DEVICE:SILICON,40PIV,150MA	07910	1N4152
CR167	152-0185-00			SEMICOND DEVICE:SILICON,40PIV,150MA	07910	1N4152
DS248	150-0111-00	B010100	B079999	LAMP,GLOW:NEON,1.2MA	53944	A1B-3
DS248	150-0130-00	B080000		LAMP,INCAND:5V,60MA	08806	2200DX
DS249	150-0111-00	B010100	B079999	LAMP,GLOW:NEON,1.2MA	53944	A1B-3
DS249	150-0130-00	B080000		LAMP,INCAND:5V,60MA	08806	2200DX
DS270	150-0099-00	B010100	B039999	LAMP,INCAND:T1 3/4",5V,15MA	08806	2218
DS270	150-0046-00	B040000		LAMP,INCAND:10V,0.04A	08806	2107D

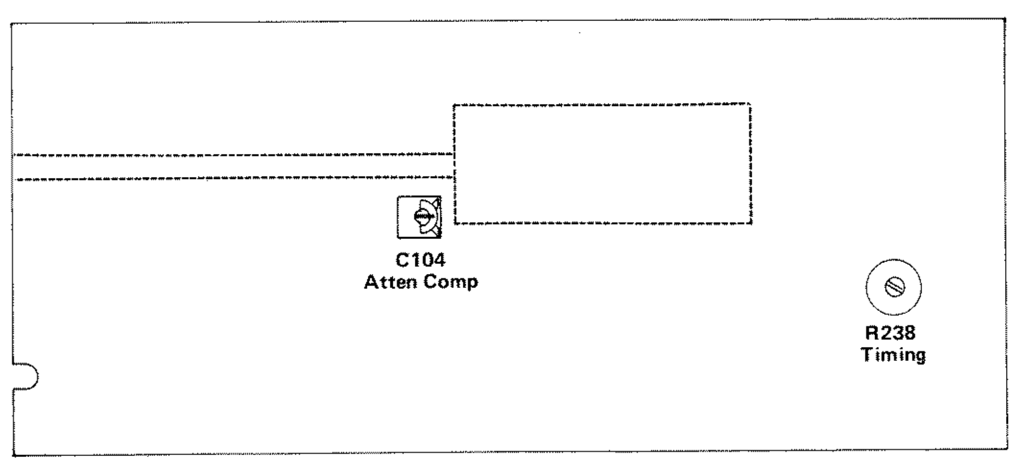
[1] Individual timing capacitors in this assembly must be ordered by the 9-digit part number, letter suffix and tolerance printed on the timing capacitor to be replaced. The letter suffix and the tolerance should be the same for all of the timing capacitors in the assembly.
EXAMPLE: 285-XXXX-XX F-

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
J101	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
Q128	151-1049-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	80009	151-1049-00
Q132	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q133	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q144	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q214	151-0254-00			TRANSISTOR:SILICON,NPN	80009	151-0254-00
Q246	151-0224-00			TRANSISTOR:SILICON,NPN	07263	2N3904
R101	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R103	322-0621-01			RES.,FXD,FILM:900K OHM,0.5%,0.25W	75042	CEBT0-9003D
R105	321-0645-00			RES.,FXD,FILM:100K OHM,0.5%,0.125W	91637	MFF1816D10002D
R112	316-0224-00			RES.,FXD,CMPSN:220K OHM,10%,0.25W	01121	CB2241
R113	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R114	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R121	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R122	316-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,0.25W	01121	CB3321
R124	316-0330-00			RES.,FXD,CMPSN:33 OHM,10%,0.25W	01121	CB3301
R128	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R129	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R130	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R131	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R132	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R133	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R134	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R135	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R136	315-0304-00			RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
R137	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R138	315-0201-00	XB076059		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R139	316-0391-00			RES.,FXD,CMPSN:390 OHM,10%,0.25W	01121	CB3911
R142	321-0158-00			RES.,FXD,FILM:432 OHM,1%,0.125W	91637	MFF1816G432R0F
R143	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R144	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R145	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	91637	MFF1816G453R0F
R150	311-0467-01	B010100	B039999	RES.,VAR,NONWIR.50W	80009	311-0467-01
R150	311-1483-00	B040000		RES.,VAR,NONWIR:100K OHM,20%,1W	01121	11M109
R151	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R152	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R155	316-0223-00			RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
R161	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R162	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R163	316-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R164	316-0122-00			RES.,FXD,CMPSN:1.2K OHM,10%.0.25W	01121	CB1221
R165	316-0332-00			RES.,FXD,CMPSN:3.3K OHM,10%,0.25W	01121	CB3321
R167	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R169	316-0270-00			RES.,FXD,CMPSN:27 OHM,10%,0.25W	01121	CB2701
R171	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R172	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R173	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R176	307-0113-00			RES.,FXD,CMPSN:5.1 OHM,5%,0.25W	01121	CB51G5
R179	316-0223-00			RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
R203	316-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R206	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R208	321-0414-00			RES.,FXD,FILM:200K OHM,1%,0.125W	91637	MFF1816G20002F

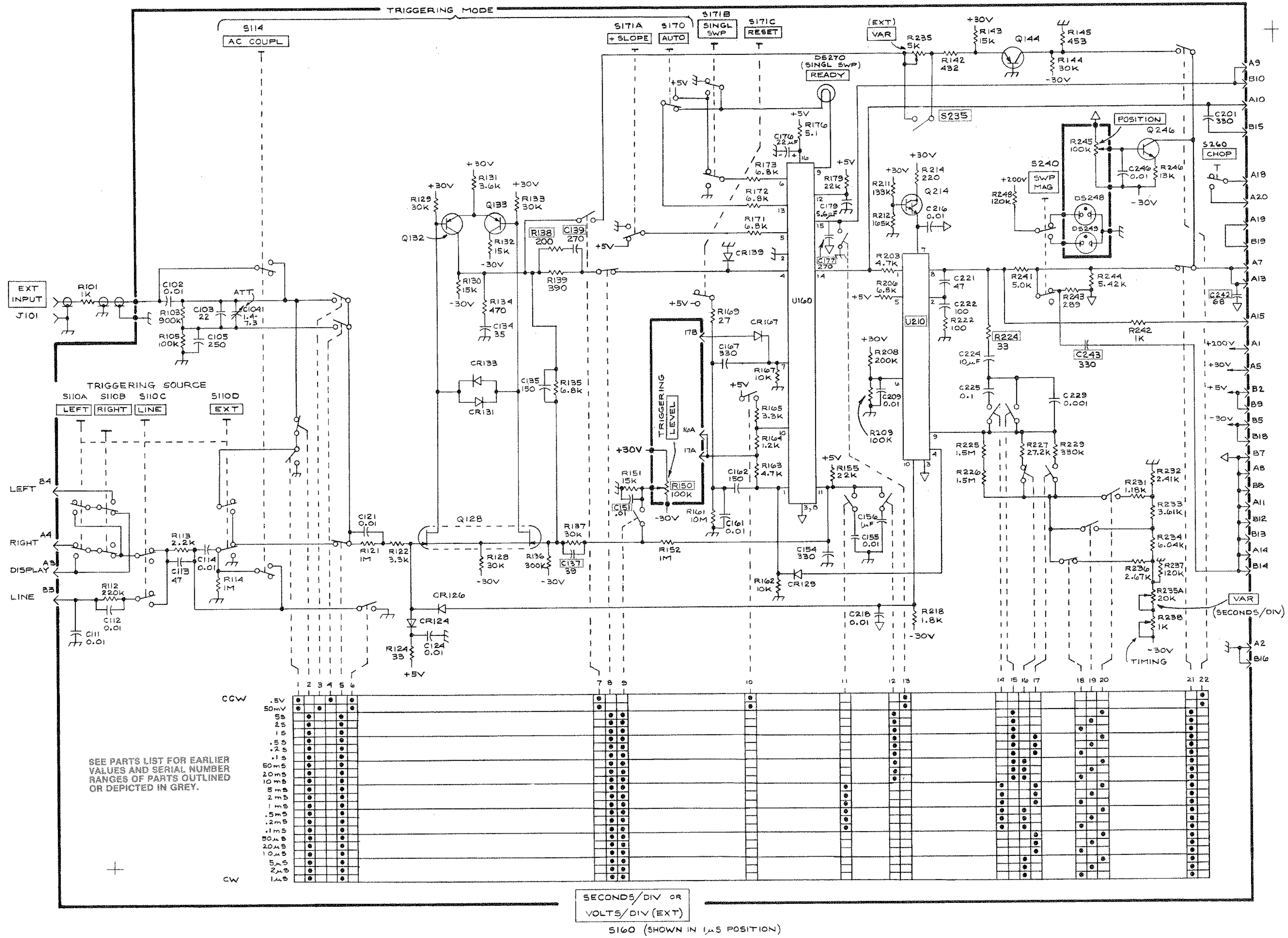
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R209	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816F10002F
R211	321-0397-00			RES.,FXD,FILM:133K OHM,1%,0.125W	91637	MFF1816G13302F
R212	321-0406-00			RES.,FXD,FILM:165K OHM,1%,0.125W	91637	MFF1816G16502F
R214	316-0221-00			RES.,FXD,CMPSN:220 OHM,10%,0.25W	01121	CB2211
R218	301-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.5W	01121	EB1825
R222	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R224	315-0330-00	XB075503		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R225	323-0498-03			RES.,FXD,FILM:1.5M OHM,0.25%,0.50W	91637	HFF12915003C
R226	323-0498-03			RES.,FXD,FILM:1.5M OHM,0.25%,0.50W	91637	HFF12915003C
R227	321-0917-03			RES.,FXD,FILM:27.2K OHM,0.25%,0.125W	91637	MFF1816D27201C
R229	321-0856-03			RES.,FXD,FILM:330K OHM,0.25%,0.125W	91637	MFF1816D33002C
R231	321-0200-00			RES.,FXD,FILM:1.18K OHM,1%,0.125W	91637	MFF1816G11800F
R232	321-0830-03			RES.,FXD,FILM:2.41K OHM,0.25%,0.125W	91637	MFF1816D24100C
R233	321-0827-03			RES.,FXD,FILM:3.61K OHM,0.25%,0.125W	91637	MFF1816D36100C
R234	321-0268-03			RES.,FXD,FILM:6.04K OHM,0.25%,0.125W	91637	MFF1816D60400C
R235, R235A [1]	311-1128-00			RES.,VAR,NONWIR:20K OHM X 5K OHM,20%,0.50W	71590	BA164-003
R236	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	91637	MFF1816G26700F
R237	316-0124-00			RES.,FXD,CMPSN:120K OHM,10%,0.25W	01121	CB1241
R238	311-1123-00			RES.,VAR,NONWIR:1K OHM,30%,0.25W	71450	201-YA5532
R241	321-0816-03			RES.,FXD,FILM:5K OHM,0.25%,0.125W	91637	MFF1816D50000C
R242	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R243	321-0916-03			RES.,FXD,FILM:289 OHM,0.25%,0.125W	91637	MFF1816D289R0C
R244	321-1263-02			RES.,FXD,FILM:5.42K OHM,0.5%,0.125W	91637	MFF1816D54200D
R245	311-0467-01			RES.,VAR,NONWIR.50W	80009	311-0467-01
R246	321-0300-00			RES.,FXD,FILM:13K OHM,1%,0.125W	91637	MFF1816G13001F
R248	316-0124-00	B010100	B079999	RES.,FXD,CMPSN:120K OHM,10%,0.25W	01121	CB1241
R248	315-0270-00	B080000		RES.,FXD,CMPSN:27 OHM,10%,0.25W	01121	CB2705
S100A, S100B, S100C, S100D	260-1213-00			SWITCH,PUSH:LINE (DIS LEFT / PLAY RIGHT / LINE / EXT)	71590	2KBC040000 457
S114	260-1208-00			SWITCH,PUSH:DPDT	80009	260-1208-00
S160	105-0244-00			DRUM ASSY,CAM S:SECONDS/DIV OR VOLTS/DIV(EXT)	80009	105-0244-00
S170	260-1208-00			SWITCH,PUSH:DPDT	80009	260-1208-00
S171A, S171B, S171C	260-1212-00			SWITCH,PUSH:SINGLE SWP (+ SLOPE / SINGLE SWP / RESET)	71590	2KBM003000 458
S235 [2]		XB040000				
S240	260-1208-00			SWITCH,PUSH:DPDT	80009	260-1208-00
S260	260-1211-00			SWITCH,PUSH:DPDT,PUSH-PUSH	80009	260-1211-00
U160	155-0029-01	B010100	B029999	MICROCIRCUIT,DI:SWEEP CONTROL	80009	155-0029-01
U160	155-0056-00	B030000		MICROCIRCUIT,DI:SWEEP CONTROL	80009	155-0056-00
U210	155-0042-01	B010100	B029999	MICROCIRCUIT,DI:MILLER INTEGRATOR	80009	155-0042-01
U210	155-0042-03	B030000		MICROCIRCUIT,DI:MILLER INTEGRATOR	80009	155-0042-03

[1] Furnished as a unit with S235.
[2] Furnished as a unit with R235, R235A.





Calibrator control locations.



5B10N

REV. G, FEB. 1977

TIME BASE

EEB

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
--- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
--- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
--- * ---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- * --- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

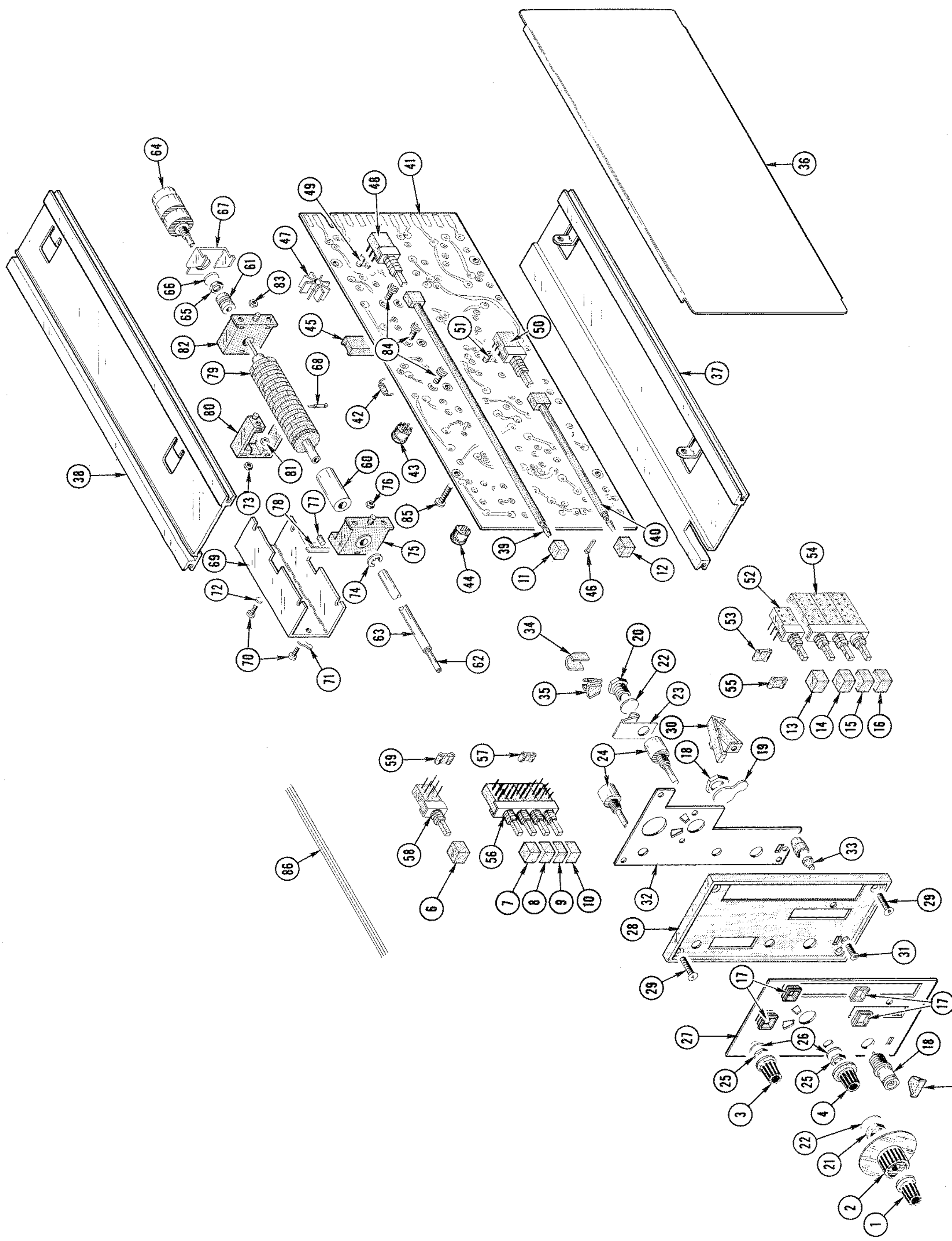
Mfr. Code	Manufacturer	Address	City, State, Zip
05091	TRI-ORDINATE CORPORATION	343 SNYDER AVENUE	BERKELEY HEIGHTS, NJ 07922
05820	WAKEFIELD ENGINEERING, INC.	AUDUBON ROAD	WAKEFIELD, MA 01880
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	366-1317-00			1	KNOB:RED	80009	366-1317-00
	213-0153-00			1	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-2	366-1294-00			1	PUSH BUTTON:V/DIV	80009	366-1294-00
	213-0153-00			2	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-3	366-0494-00			1	KNOB:GRAY	80009	366-0494-00
	213-0153-00			1	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-4	366-0494-00			1	KNOB:GRAY	80009	366-0494-00
	213-0153-00			1	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-5	366-1286-00	B010100	B039999	1	KNOB:LATCH	80009	366-1286-00
	366-1286-03	B040100		1	KNOB:LATCH,SILVER	80009	366-1286-03
	214-1840-00	XB040000		1	PIN,KNOB SECRG:0.094 OD X 0.120 INCH LONG	80009	214-1840-00
-6	366-1257-31			1	PUSH BUTTON:CHOP	80009	366-1257-31
-7	366-1257-21			1	PUSH BUTTON:LEFT-DISPL	80009	366-1257-21
-8	366-1257-22			1	PUSH BUTTON:TRIG RIGHT	80009	366-1257-22
-9	366-1257-23			1	PUSH BUTTON:LINE	80009	366-1257-23
-10	366-1257-24			1	PUSH BUTTON:GRAY--EXT	80009	366-1257-24
-11	366-1257-25			1	PUSH BUTTON:SWP MAG	80009	366-1257-25
-12	366-1257-27			1	PUSH BUTTON:--AC COUPL	80009	366-1257-27
-13	366-1257-26			1	PUSH BUTTON:GRAY--AUTO TRI	80009	366-1257-26
-14	366-1257-28			1	PUSH BUTTON:GRAY--+SLOPE	80009	366-1257-28
-15	366-1257-29			1	PUSH BUTTON:GRAY--SNGL SWP	80009	366-1257-29
-16	366-1257-30			1	PUSH BUTTON:GRAY--RESET	80009	366-1257-30
-17	426-0681-00			11	FR,PUSH BUTTON:GRAY PLASTIC	80009	426-0681-00
-18	131-0955-00			1	CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
					(ATTACHING PARTS)		
-19	210-0255-00			1	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
					- - - * - - -		
-20	358-0029-00			1	BSHG,MACH.THD:HEX,0.375-32 X 0.438"LONG	80009	358-0029-00
					(ATTACHING PARTS)		
-21	210-0590-00			1	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-22	210-0012-00			2	WASHER,LOCK:INTL,0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
-23	344-0195-01	B010100	B029999	1	CLIP,ELECTRICAL:CAM SHAFT	80009	344-0195-01
					- - - * - - -		
-24	----- -----			2	RES.,VAR,NONWIR:(SEE R150 & R245 EPL)		
					(ATTACHING PARTS)		
-25	210-0583-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-26	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					- - - * - - -		
-27	333-1387-00			1	PANEL,FRONT:	80009	333-1387-00
-28	386-1915-00			1	SUBPANEL,FRONT:	80009	386-1915-00
					(ATTACHING PARTS)		
-29	213-0229-00			4	SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-30	214-1513-00	B010100	B039999	1	LCH,PLUG-IN RET:	80009	214-1513-00
	214-1513-01	B040000		1	LCH,PLUG-IN RET:	80009	214-1513-01
					(ATTACHING PARTS)		
-32	337-1395-00			1	SUBPANEL:	80009	337-1395-00
-33	378-0541-00			1	LENS,LIGHT:FROSTED	80009	378-0541-00
-34	337-1430-00			2	SHIELD,LIGHT:LAMP	80009	337-1430-00
-35	136-0431-00			2	RETAINER,LAMP:	80009	136-0431-00
-36	337-1399-00			2	SHLD,ELECTRICAL:SIDE	80009	337-1399-00
-37	426-0724-00			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0724-00
-38	426-0725-00			1	FR SECT,PLUG-IN:TOP	80009	426-0725-00
-39	384-1060-00			1	EXTENSION SHAFT:7.831 INCH LONG	80009	384-1060-00
-40	384-1061-00			1	EXTENSION SHAFT:3.981 INCH LONG	80009	384-1061-00
-41	----- -----			1	CKT BOARD ASSY:MAIN(SEE A1 EPL)		
-42	131-0566-00			1	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
-43	136-0235-00			1	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-44	136-0241-00			1	. SOCKET,PLUG-IN:10 CONTACT,ROUND	71785	133-99-12-064
-45	136-0260-01			1	. SOCKET,PLUG-IN:16 CONTACT,RECT SHAPE	71785	133-51-02-075
-46	214-0579-00			3	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-47	214-1291-00			1	. HEAT SINK,ELEC:XSTR,0.72 OD X 0.375"H	05820	207-AB

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-48	----- -----			1	. SWITCH,PUSH:DPDT(SEE S240 EPL)		
					(ATTACHING PARTS)		
-49	361-0382-00			2	. SPACER,PB SW:BROWN,0.275 INCH LONG	80009	361-0382-00
					- - - * - - -		
-50	----- -----			1	. SWITCH,PUSH:DPDT(SEE S114 EPL)		
					(ATTACHING PARTS)		
-51	361-0573-00			2	. SPACER,SLEEVE:	71590	J75816
					- - - * - - -		
-52	----- -----			1	. SWITCH,PUSH:DPDT(SEE S170 EPL)		
					(ATTACHING PARTS)		
-53	361-0573-00			2	. SPACER,SLEEVE:	71590	J75816
					- - - * - - -		
-54	----- -----			1	. SWITCH,PUSH:(SEE S171 EPL)		
					(ATTACHING PARTS)		
-55	361-0382-00			4	. SPACER,PB SW:BROWN,0.275 INCH LONG	80009	361-0382-00
					- - - * - - -		
-56	----- -----			1	. SWITCH,PUSH:(SEE S110 EPL)		
					(ATTACHING PARTS)		
-57	361-0384-00			4	. SPACER,PB SW:0.133 INCH LONG	80009	361-0384-00
					- - - * - - -		
-58	----- -----			1	. SWITCH,PUSH:(SEE S260 EPL)		
					(ATTACHING PARTS)		
-59	361-0383-00			2	. SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
					- - - * - - -		
-60	376-0007-00			1	. CPLG,SHAFT,RIGI:	80009	376-0007-00
	213-0005-00			2	. . SETSCREW:8-32 X 1.25 INCH,HEX SOC STL	74445	OBD
-61	376-0051-00			1	. CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-00
	376-0049-00			1	. . CPLG,SHAFT,FLEX:PLASTIC	80009	376-0049-00
	354-0251-00			2	. . RING,COUPLING:0.251 ID X 0.375 INCH OD,AL	80009	354-0251-00
	213-0022-00			4	. . SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
-62	384-1057-00			1	. EXTENSION SHAFT:10.25 L X 0.125 ID SST	80009	384-1057-00
-63	384-1062-00			1	. EXTENSION SHAFT:5.118 L X 0.248 OD BRS	80009	384-1062-00
-64	----- -----			-	. RES.,VAR,NONWIR:(SEE R235 EPL)		
					(ATTACHING PARTS)		
-65	210-0583-00			1	. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-66	210-0046-00			1	. WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-67	407-0803-00			1	. BRKT,COMPONENT:	80009	407-0803-00
					- - - * - - -		
-68	131-0604-00			22	. CONTACT,ELEC:CKT CD SW,SPR	80009	131-0604-00
	105-0244-00			1	. ACTR ASSY,CAMS:TIME/DIV	80009	105-0244-00
-69	200-1196-00			1	. . COVER,CAM SW:	80009	200-1196-00
					(ATTACHING PARTS)		
-70	211-0022-00			4	. . SCREW,MACHINE:2-56 X 0.188 INCH,PNH STL	83385	OBD
-71	210-0259-00			1	. . TERMINAL,LUG:0.099"ID INT TOOTH,SE	80009	210-0259-00
-72	210-0001-00			3	. . WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
-73	210-0405-00	B010100	B029999	4	. . NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	2X12157-402
	220-0636-00	B030000		4	. . NUT,PLAIN,HEX.:2-56 X 0.188 INCH HEX,BRS	73743	OBD
	131-1219-00	B030000		1	. . CONTACT,ELEC:GROUNDING	80009	131-1219-00
-74	354-0219-00			1	. . RING,RETAINING:FOR 0.25 INCH SHAFT	79136	5103-25-MD-R
-75	401-0057-00			1	. . BEARING,CAM SW:FRONT	80009	401-0057-00
					(ATTACHING PARTS)		
-76	210-0406-00			2	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
					- - - * - - -		
-77	214-1127-00			1	. . ROLLER,DETENT:0.125 DIA X 0.125 INCH L	80009	214-1127-00
-78	214-1139-00[1]			-	. . SPRING,FLAT:GOLD COLORED	80009	214-1139-00
	214-1139-02[1]			-	. . SPRING,FLAT:GREEN COLORED	80009	214-1139-02
	214-1139-03[1]			-	. . SPRING,FLAT:RED COLORED	80009	214-1139-03
-79	105-0222-00			1	. . DRUM,CAM SWITCH:TIME/DIV	80009	105-0222-00
-80	407-0653-00			1	. . BRACKET,COVER:CAM SWITCH	80009	407-0653-00
					(ATTACHING PARTS)		
-81	210-0406-00			2	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
					- - - * - - -		

[1]Replace only with part bearing the same color as the original part in your instrument.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-82	401-0056-00			1	. . BEARING CAM SW:REAR	80009	401-0056-00
					(ATTACHING PARTS)		
-83	210-0406-00			2	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
					- - - * - - -		
					(ATTACHING PARTS FOR ACTR ASSY)		
-84	211-0116-00			6	. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
					(ATTACHING PARTS FOR CKT BD ASSY)		
-85	213-0146-00			4	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
					- - - * - - -		
-86	175-0826-00			FT	WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00



Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
	070-1140-00			1	MANUAL,TECH:INSTRUCTION	80009	070-1140-00

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
114	PG 501 - ±5 V output.	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output.
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 μs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 μs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 μs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

TEXT CORRECTION

SECTION 3 CIRCUIT DESCRIPTION

Discrete Miller Integrator

The discrete Miller integrator is designed as a direct replacement for the M018 (155-0042-03) I.C. in the 5B10N. Circuit operation is as follows:

A + gate at pin 1 turns Q1 on causing the collector to fall which turns off Q5, allowing the ramp to run up.

When the ramp runs up (pin 8) to 10 volts, Q6 is turned off and Q7 switches on, its collector going positive. This positive excursion at the collector of Q7 is the sweep stop signal.

The sweep stop output causes the sweep start gate to go negative, turning Q1 off and Q5 on, which discharges the timing capacitor.

The offset adjustment is provided to equalize the current through Q2 and Q3, thereby creating equal source-gate bias.

SECTION 4 CALIBRATION

Before calibrating the basic timing on the 5B10N, the OFFSET on the discrete Miller integrator board should be adjusted as follows:

With the time/div. at 2 ms, probe pin 9 (null point) with an X10 probe. Adjust the offset pot so that the half-way point on the ramp crosses zero volts. The ramp will appear as negative going at this point and should be viewed at 10 mv/div. sensitivity.

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

REMOVE:

U210	155-0042-03	Monolithic, Miller integrator and delay pickoff

ADD:

ASSEMBLY

A2	670-3158-00	Discrete Miller Integrator, Circuit Board Assembly

ADD:

CAPACITORS

C1	281-0504-00	10 pF, Cer, 500 V, 10%

SEMICONDUCTOR DEVICE, DIODES

CR1	152-0141-02	Silicon, 1N4152
VR1	152-0166-00	Zener, selected from 1N753A, 0.4 W, 6.2 V, 5%

TRANSISTORS

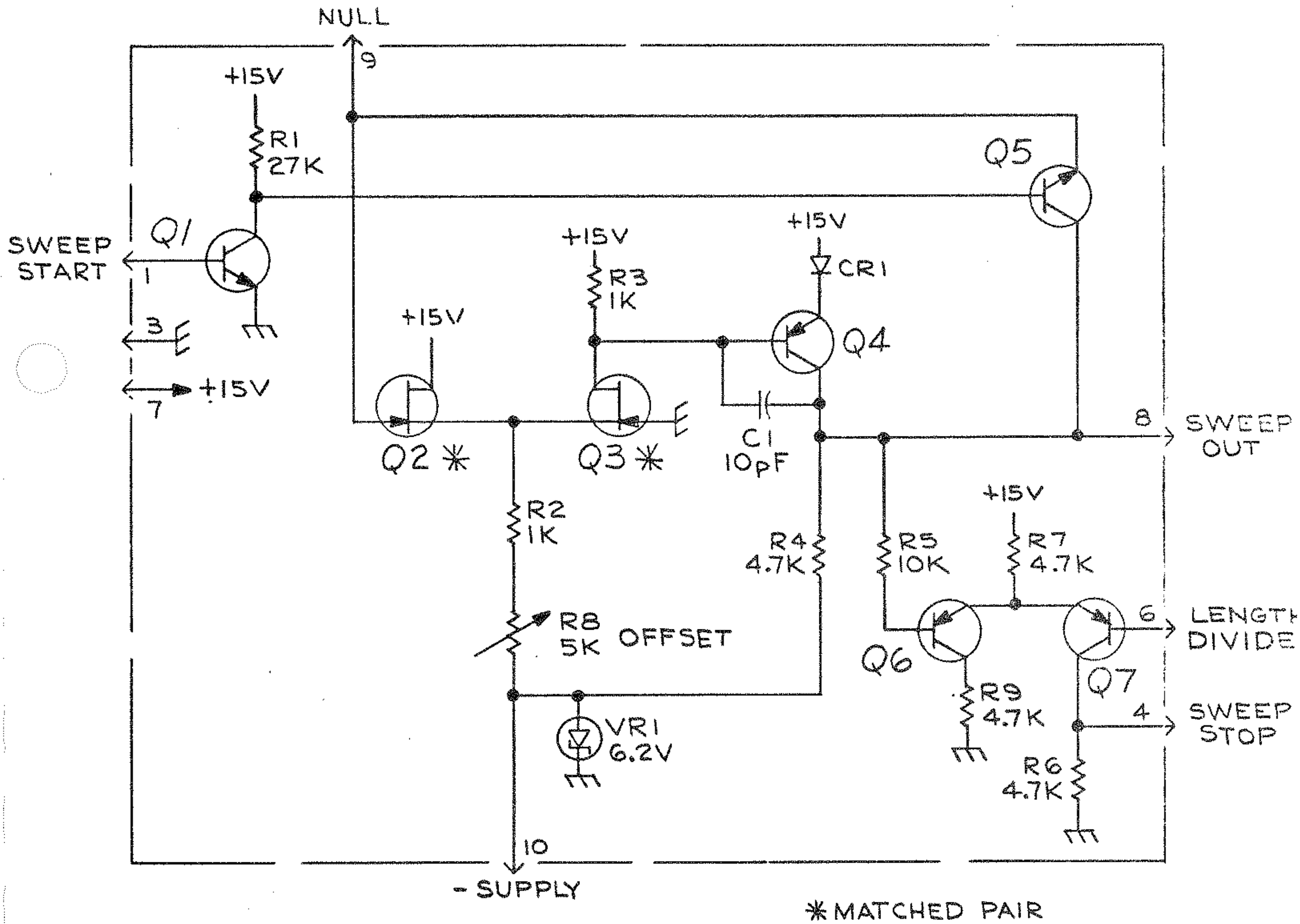
Q1	151-0341-00	Silicon, NPN, 2N3565
Q2 } Q3	151-1042-00	FET, N channel, 2N5245, pair
Q4	151-0216-00	Silicon, PNP, MPS 6523
Q5	151-0283-00	Silicon, NPN, selected from 2N3933
Q6	151-0342-00	Silicon, PNP, 2N4249
Q7	151-0342-00	Silicon, PNP, 2N4249

RESISTORS

R1	315-0273-00	27 kΩ, 1/4 W, 5%
R2	315-0102-00	1 kΩ, 1/4 W, 5%
R3	315-0102-00	1 kΩ, 1/4 W, 5%
R4	315-0472-00	4.7 kΩ, 1/4 W, 5%
R5	315-0103-00	10 kΩ, 1/4 W, 5%
R6	315-0472-00	4.7 kΩ, 1/4 W, 5%
R7	315-0472-00	4.7 kΩ, 1/4 W, 5%
R8	311-1560-00	5 kΩ, Var
R9	315-0472-00	4.7 kΩ, 1/4 W, 5%

SCHEMATIC ADDITION

A2 670-3158-00 Discrete Miller Integrator
Circuit Board Assembly



TEKTRONIX®
committed to technical excellence

MANUAL CHANGE INFORMATION

PRODUCT 5B10N 070-1140-00	CHANGE REFERENCE M31688
	DATE 5-11-77

CHANGE:	DESCRIPTION

EFF SN B080000-up

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

A1	670-1345-01	CKT BOARD ASSY:MAIN
DS248	150-0130-00	LAMP,INCANDESCENT
DS249	150-0130-00	LAMP,INCANDESCENT
R248	315-0270-00	RES.,FXD,CMPSN:27 OHM,5%,0.25W